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**PROGRAM  
and  
PROCEEDINGS**

**THE NEBRASKA ACADEMY  
OF  
SCIENCES**

**1880-2012**

**including the**

**Nebraska Association of Teachers of Science**

**(NATS) Division**

**Nebraska Junior Academy of Sciences**

**(NJAS) Division**

**and**

**Affiliated Societies**



**132nd Anniversary Year**

***One Hundred-Twentysecond Annual Meeting***

**April 20, 2012**  
**OLIN HALL OF SCIENCE - NEBRASKA WESLEYAN UNIVERSITY**  
**LINCOLN, NEBRASKA**

**NEBRASKA ASSOCIATION OF TEACHERS OF SCIENCE (NATS)**

The 2012 Fall Conference of the Nebraska Association of Teachers of Science (NATS) will be held at Camp Calvin Crest, near Fremont, September 27 - September 29 (Thursday, Friday, and Saturday).

President: Jon Pedersen, University of Nebraska–Lincoln, NE

President-Elect: Mary Moser, Pawnee City High School, Pawnee City, NE

**AFFILIATED SOCIETIES OF THE NEBRASKA ACADEMY OF SCIENCES, INC.**

**1. American Association of Physics Teachers, Nebraska Section**

Web site: <http://www.cune.edu/facweb/brent.royuk/naapt/about.htm>

**2. Friends of Loren Eiseley**

Web site: <http://www.eiseley.org>

**3. Lincoln Gem & Mineral Club**

Web site: <http://www.lincolngemmineralclub.org/>

**4. Nebraska Chapter, National Council for Geographic Education**

**5. Nebraska Geological Society**

Web site: <http://maps.unomaha.edu/ngs/>

Sponsors of a \$50 award to the outstanding student paper presented at the Nebraska Academy of Sciences Annual Meeting, Earth Science Section

**6. Nebraska Graduate Women in Science**

**7. Nebraska Ornithologists' Union**

Web site: <http://www.noubirds.org/>

Publishers of the quarterly, *The Nebraska Bird Review*

Spring Meeting, May 18 - 20, 2012, Broken Bow, NE

**8. Nebraska Psychological Society**

<http://www.nebpsych.org/>

**9. Nebraska-Southeast South Dakota Section Mathematical Association of America**

Web site: <http://math.creighton.edu/maa/>

Spring Meeting, March 30-31, 2012, Midland University, Fremont, NE

**10. Nebraska Space Grant Consortium**

Web site: <http://www.ne.spacegrant.org/>

**THE NEBRASKA SPACE GRANT CONSORTIUM MADE A GENEROUS CONTRIBUTION TO THE  
ACADEMY TO HELP DEFRAY COSTS OF THIS MEETING**

# **THE NEBRASKA ACADEMY OF SCIENCES, INC.**

302 Morrill Hall, 14th & U Streets

Lincoln, Nebraska 68588-0339

Affiliated with the American Association for the Advancement of Science

And

National Association of Academies of Science

## **GENERAL INFORMATION**

Members and visitors will be registered at Olin Hall of Science, Nebraska Wesleyan University, 50th & St. Paul, Lincoln, Nebraska. The registration fee is \$60.00 for General Registrants which includes dues and \$15.00 for students with a VALID student ID. Registrants are entitled to the PROGRAM/PROCEEDINGS and to attend any of the section meetings. Junior and senior high school students will register at a separate area, FREE.

Additional copies of the PROGRAM/PROCEEDINGS may be obtained at the Registration Desk or, after the meeting, at the Academy Office, for \$4.00/copy.

The Nebraska Academy of Sciences was organized on January 30, 1880 with monthly scheduled meetings in Omaha, Nebraska. The Academy was reorganized on January 1, 1891 and annual meetings have been held thereafter.

AUTHORS ARE INVITED TO SUBMIT MANUSCRIPTS OF THEIR WORK FOR PUBLICATION IN THE TRANSACTIONS OF THE NEBRASKA ACADEMY OF SCIENCES, a technical journal published periodically by the Academy for 34 years.

Articles in all areas of science, science education, and history of science are welcomed, including results of original research as well as reviews and syntheses of knowledge.

The *Transactions* is moving to a digital format. The *Transactions* is distributed free to all members of the Academy and to about 400 libraries worldwide, and it is abstracted by major abstracting services.

Two hard copies and one electronic copy of each manuscript should be submitted to the Nebraska Academy of Sciences, 302 Morrill Hall, 14<sup>th</sup> and U Street, Lincoln NE 68588-0339. (402) 472-2644, nebacad@unl.edu

Our website address is <[www.neacadsci.org](http://www.neacadsci.org)>.

## **PROGRAM**

### **FRIDAY, APRIL 20, 2012**

- 7:30 a.m. REGISTRATION FOR ACADEMY, Lobby of Lecture wing, Olin Hall
- 8:00 Aeronautics and Space Science, Session A, Olin 249  
Aeronautics and Space Science, Session B, Olin 224  
Collegiate Academy, Biology Session A, Olin B  
Chemistry and Physics, Section A, Chemistry, Olin A
- 8:10 Applied Science and Technology, Olin 325
- 8:30 Biological and Medical Sciences, Session A, Olin 112  
Biological and Medical Sciences, Session B, Smith Callen Conference Center  
Junior Academy, Judges Check-In, Olin 219  
Junior Academy, Senior High REGISTRATION, Olin Hall Lobby
- 8:50 Chemistry and Physics, Section B, Physics, Planetarium
- 9:00 Collegiate Academy, Chemistry and Physics, Session A, Olin 324  
Junior Academy, Senior High Competition, Olin 124, Olin 131
- 9:10 Aeronautics and Space Science, Poster Session, Olin 249
- 9:30 NWU Health and Sciences Graduate School Fair, Olin and Smith Curtiss Halls
- 10:30 Aeronautics and Space Science, Poster Session, Olin 249
- 11:00 MAIBEN MEMORIAL LECTURE, OLIN B  
"Buffalo Bruce" McIntosh, Research Ecologist with Western Nebraska Resources Council, "The Status of Nebraska's Native Aspen"
- 12:00 LUNCH, PATIO ROOM, STORY STUDENT CENTER  
(pay and carry tray through cafeteria line, or pay at NAS registration desk)  
Aeronautics Group, Conestoga Room
- 1:00 p.m. Anthropology, Olin 111  
Biological and Medical Sciences, Session C, Olin 112  
Biological and Medical Sciences, Session D, Smith Callen Conference Center  
Chemistry and Physics, Section A, Chemistry, Olin A  
Chemistry and Physics, Section B, Physics, Planetarium  
Collegiate Academy, Biology Session A, Olin B  
Collegiate Academy, Biology Session B, Olin 249  
Collegiate Academy, Chemistry and Physics, Session B, Olin 324  
Earth Science, Olin 224
- 1:00 History/Philosophy of Science, Olin 325  
Junior Academy, Judges Check-In, Olin 219  
Junior Academy, Junior High REGISTRATION, Olin Hall Lobby  
Junior Academy, Senior High Competition, (Final), Olin 110
- 1:20 Teaching of Science and Math, Olin 325
- 1:30 Junior Academy, Junior High Competition, Olin 124, Olin 131
- 2:00 NJAS Board/Teacher Meeting, Olin 219
- 4:45 BUSINESS MEETING, OLIN B
- 5:45 AWARDS RECEPTION for NJAS, Scholarships, Members, Spouses, and Guests  
First United Methodist Church, 2723 N 50th Street, Lincoln, NE

\*For papers with more than one author, an asterisk follows the name of the author(s) who plans to present the paper at the meeting.

**AERONAUTICS AND SPACE SCIENCE**

Chairperson: Scott E. Tarry

NASA Nebraska Space Grant & EPSCoR, University of Nebraska at Omaha

**SESSION A**

Olin 249

- 8:00 a.m. 1. PHOTOIONIZATION MODEL ANALYSIS OF X-RAY OBSERVATIONS: SEYFERT GALAXY NGC-4151. Adam Hester, Department of Physics, Creighton University, Omaha.
- 8:10 2. VIEW OF AGN OUTFLOWS THROUGH THE MID-IR. Barbara Medvar\* and Jack Gabel, Department of Physics, Creighton University, Omaha.
- 8:20 3. BROAD ABSORPTION LINES AND THEIR RELATION TO OTHER SPECTRAL FEATURES OF AGNS. Dan McGinnis, Department of Physics, Creighton University, Omaha.
- 8:30 4. KINEMATIC VARIABILITY OF ABSORBERS IN THE SEYFERT 1 GALAXY NGC 3783. David Austerberry, Department of Physics, Creighton University, Omaha.
- 8:40 5. EFFECTS OF MULTICOMPONENT DIFFUSION ON THE AUTO-IGNITION PHENOMENON WITH DETAILED CHEMICAL MECHANISMS. Inkant Awasthi\* and George Gogos, Department of Mechanical & Materials Engineering, University of Nebraska–Lincoln.
- 8:50 6. THE INTEGRATION OF PROPANE FLAMING AND MECHANICAL CULTIVATION FOR EFFECTIVE CONTROL IN AGRICULTURE. Brian Neilson\*, Chris Bruening, and George Gogos, Department of Mechanical & Materials Engineering, University of Nebraska–Lincoln.
- 9:00 7. ROBOTIC PLEURAL CATHETER INSERTION. Jeff Hawks, Department of Mechanical & Materials Engineering, University of Nebraska–Lincoln.
- 9:10 BREAK/POSTER PRESENTATIONS

- 9:30      8. IMPACT OF ENVIRONMENTAL DISTRACTION ON SKILLS PERFORMANCE DURING TELESURGERY: EFFECTS OF SURGICAL EXPERIENCE AND FATIGUE. Ka-Chun Siu\*, Department of Environmental, Agricultural, and Occupational Health Science and Irene Suh, College of Public Health/Occupational Health & Center of Advanced Surgical Technology, University of Nebraska Medical Center, Omaha; and Michael Head and Carl Nelson, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln.
- 9:40      9. MODULAR JOYSTICK DESIGN AND DISTRACTIONS IN VR SURGICAL SKILLS TRAINING. Ka-Chun Siu, Department of Environmental, Agricultural, and Occupational Health Science, University of Nebraska Medical Center, Omaha; and Carl Nelson and Michael Head\*, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln.
- 9:50      10. RECENT PROGRESS ON MODRED – A MODULAR SELF-RECONFIGURABLE ROBOT SYSTEM FOR SPACE EXPLORATION. S.G.M. Hossain\* and Carl Nelson, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln; and Prithviraj Dasgupta, Department of Computer Science, University of Nebraska at Omaha.
- 10:00     11. DYNAMIC RECONFIGURATION IN MODULAR ROBOTS USING GRAPH PARTITIONING. Raj Dasgupta\*, Department of Computer Science; Vladimir Ufimtsev, College is IS&T, University of Nebraska at Omaha; and Carl Nelson, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln.
- 10:10     12. COMPLIANT GRASPING SYSTEMS FOR SPACE SURGERY. Alan Goyzueta\* and Carl Nelson, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln.
- 10:20     13. LIGHTWEIGHT TOOL HOIST FOR REDUCED GRAVITY SIMULATOR. Eric Markvicka\*, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln; and Larry Dungan, Thomas Cunningham, and Dina Poncia, ARGOS, Johnson Space Center, Houston.
- 10:30      BREAK/POSTER PRESENTATIONS
- 10:50     14. INVESTIGATING THE EFFECTS OF VARIOUS KINDS OF CHAOTIC AUDITORY STIMULUS ON THE WALKING PATTERNS OF BOTH HUMAN SUBJECTS AND A COMPUTER MODEL. Nate Hunt, Nebraska Biomechanics Core Facility, University of Nebraska at Omaha.

- 11:00 15. EFFECTIVENESS OF AN ELASTIC LOAD-BASED EXERCISE PROGRAM IN IMPROVING BALANCE IN HEALTHY INDIVIDUALS. Jon Carey\* and Sara Myers, Nebraska Biomechanics Core Facility, University of Nebraska at Omaha.
- 11:10 16. GAZE AND POSTURAL COUPLING TO VISUAL STIMULUS MOTION OF VARIOUS FREQUENCY STRUCTURE. Joshua L. Haworth\*, Srikant Vallabhajosula, and Nicholas Stergiou, Nebraska Biomechanics Core Facility, University of Nebraska at Omaha.
- 11:20 17. DYNAMIC POSTURAL CONTROL USING THE LOCOMOTOR SENSORY ORGANIZATION TEST. Austin Davidson\*, Jun Hung Chen, Mukul Mukherjee, Sara Myers, Chun-Kai Huang, and Nicholas Stergiou, Nebraska Biomechanics Core Facility, University of Nebraska at Omaha; and Ka-Chun Siu, Department of Environmental, Agricultural, and Occupational Health Science, University of Nebraska Medical Center, Omaha.
- 11:30 18. EFFECTS OF ALTERED POTENTIAL ENERGY DURING GAIT: IMPLICATIONS OF CENTER OF MASS DISPLACEMENT IN SPACE FLIGHT. Whitney Korgan\* and Shane Wurdeman, Nebraska Biomechanics Core Facility, University of Nebraska at Omaha.
- 11:40 19. THE EFFECTS OF EXERCISE TRAINING ON ABNORMAL WALKING PATTERNS IN PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE. Chun-Kai Huang\*, Jennifer Yentes, and Daniel Blanke, Nebraska Biomechanics Core Facility, University of Nebraska at Omaha.

#### AERONAUTICS AND SPACE SCIENCE

Chairperson: Michaela Lucas

NASA Nebraska Space Grant & EPSCoR, University of Nebraska at Omaha

#### SESSION B

Olin Hall Room 224

- 8:00 a.m. 1. AUTONOMOUS ROBOTICS. Blake E. Ross\* and William Spurgeon, Department of Business and Information Technology, Western Nebraska Community College, Scottsbluff.
- 8:10 2. USING HIGH ALTITUDE BALLOON EXPERIMENT TO DETERMINE THE EFFECT OF NEAR-SPACE CONDITIONS ON SOUND. Patricia Hanus, Department of Physics, Metropolitan Community College, Omaha.
- 8:20 3. THE NASA LUNABOTICS PROJECT. Avery Quandt, Department of Computer Engineering, University of Nebraska–Lincoln.



- 8:30 4. PROPELLANT SLOSHING STUDIES IN MICROGRAVITY. Carl Nelson\*, Eldon Summerson, Bethany Drain, Jake Reher, Eric Fritz, Jake Lewis, Lena Butterfield, Chase Blazek, Devin Bertsch, Joan Yule, and Matt Stroh, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln.
- 8:40 5. DESIGN-BUILD-FLY COMPETITION FOR UNL ENGINEERING STUDENTS. Kearney Lackas, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln.
- 8:50 6. A COMPARISON OF ALTERNATIVES TO FORMALDEHYDE-CONTAINING FIXATION AND PRESERVATION SOLUTIONS. T’Essence Bessick, Department of Biology, College of Saint Mary, Omaha.
- 9:00 7. FRACTURE CHARACTERIZATION OF ADHESIVELY BONDED CARBON/EPOXY JOINTS. Yi Hua\*, Ananth Ram Mahanth Kasavajhala, and Dr. Linxia Gu, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln.
- 9:10 BREAK/POSTER PRESENTATIONS
- 9:30 8. ELECTRO DISCHARGE MACHINING (EDM) OF ADVANCED MATERIALS FOR AEROSPACE APPLICATIONS. K.P. Rajurkar, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln.
- 9:40 9. CHARACTERIZING THE MODIS AEROSOL DATA QUALITY FOR COASTAL REGIONS. Jacob Anderson\* and Jun Wang, Department of Earth and Atmospheric Sciences, University of Nebraska–Lincoln.
- 9:50 10. SATELLITE REMOTE SENSING OF VOLCANIC ASH PLUMES: CASE STUDIES AND METEOROLOGICAL INTERPRETATIONS. Collin Holmquist\* and Jun Wang, Department of Earth and Atmospheric Sciences, University of Nebraska–Lincoln; Olga Kalashnikova, NASA Jet Propulsion Laboratory, Pasadena CA.
- 10:00 11. ASSESSMENT OF PARTICULATE MATTER, SCATTERING COEFFICIENT, AND AEROSOL OPTICAL DEPTH IN BALTIMORE, MD FOR AIR QUALITY STUDIES. Samantha Strong-Henninger\*, Jun Wang, and Amy Gehring, Department of Earth and Atmospheric Science, University of Nebraska–Lincoln.
- 10:10 12. REMOTE SENSING OF SURFACE VISIBILITY IN BALTIMORE, MARYLAND. Amy Gehring\* and Jun Wang, Department of Earth and Atmospheric Science, University of Nebraska–Lincoln; Robert Levy and Lorraine Remer, Climate and Radiation Branch, NASA Goddard Space Flight Center, Greenbelt, MD.

- 10:20 13. MESOSCALE MODELING OF SMOKE TRANSPORT AND RADIATIVE IMPACT OVER THE SOUTHEAST ASIAN MARITIME CONTINENT. Jun Wang, Cui Ge\*, and Zhifeng Yang, Department of Earth and Atmospheric Sciences, University of Nebraska–Lincoln; Edward J. Hyer and Jeffrey S. Reid, Marine Meteorology Division, Naval Research Lab, Monterey, CA; Boon-Ning Chew, Centre for Remote Imaging, Sensing and Processing, National University of Singapore; and Mastura Mahmud, Earth Observation Centre, Universiti Kebangsaan Malaysia; Yongxin Zhang, National Center for Atmospheric Research, Research Applications Laboratory, Boulder, CO.
- 10:30 BREAK/POSTER PRESENTATIONS
- 10:50 14. ASTER MINERAL SPECTRAL INDICES APPLIED TO GEOLOGICAL MAPPING OF THE CHADRON DOME, DAWES COUNTY NEBRASKA. Steven Welch\* and Michael Leite, Department of Physical and Life Sciences, Chadron State College, Chadron.
- 11:00 15. A COMPARISON OF THREE VEGETATION INDICES FOR ESTIMATING GREEN LEAF BIOMASS IN A RAIN-FED CORN AND SOYBEAN FIELD ACROSS MULTIPLE GROWING SEASONS. Nwakaku Ajaere\*, Department of Geography and GIScience; Donald Rundquist, Center for Advanced Land Management Information Technologies, School of Natural Resources; Sunil Narumalani and Qingfeng Guan, Department of Geography and GIScience, University of Nebraska–Lincoln.
- 11:10 16. FIELD-SCALE ESTIMATION OF GREEN LEAF AREA INDEX USING AIRBORNE HYPERSPECTRAL IMAGES ACQUIRED OVER CORN AND SOYBEAN FIELDS. Tarlan Razzaghi\*, Anatoly Gitelson, Donald Rundquist, T.J. Arkebauer, Y. Peng, and A.L. Nguy-Robertson, Center for Advanced Land Management Information Technologies, School of Natural Resources and Department of Agronomy and Horticulture, University of Nebraska–Lincoln.
- 11:20 17. USING COMBINED VEGETATION INDICES TO IMPROVE SENSITIVITY TO THE REMOTE ESTIMATION OF GREEN LAI IN CROPS. Anthony L. Nguy-Robertson\*, Anatoly A. Gitelson, Yi Peng, and Donald Rundquist, Center for Advanced Land Management Information Technologies, School of Natural Resources; and Timothy J. Arkebauer, Department of Agronomy and Horticulture, University of Nebraska–Lincoln; and Andres Vina, Center for Systems Integration and Sustainability, Michigan State University, East Lansing, MI.
- 11:30 18. IRON OXIDE CEMENTS AS MICROBIALLY-INDUCED SEDIMENTARY STRUCTURES. Richard M. Kettler\*, David B. Loope, and Karrie A. Weber, Department of Earth and Atmospheric Sciences, University of Nebraska–Lincoln.

## ***AERONAUTICS AND SPACE SCIENCE***

Chairperson: Scott E. Tarry

NASA Nebraska Space Grant & EPSCoR, University of Nebraska at Omaha

### **POSTER SESSION**

9:10 – 9:30 a.m. & 10:30 – 10:50 a.m.

Olin Hall Room 249

THE EFFECT OF EXERCISE TRAINING ON QUALITY OF LIFE IN PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE. Jennifer Yentes\*, Chun-Kai Huang, and Daniel Blanke, Nebraska Biomechanics Core Facility, University of Nebraska at Omaha.

DESIGN OF ANKLE EXOSKELETON FOR CALF MUSCLE WEAKNESS. Shane Wurdeman\*, Sara Myers, and Nicholas Stergiou, Nebraska Biomechanics Core Facility, University of Nebraska at Omaha.

REDUCING THE IMPACT OF DISTRACTION ON REMOTE SURGICAL SKILLS LEARNING IN TELEMEDICINE. Irene Suh\* and Ka-Chun Siu, College of Public Health/Occupational Health & Center of Advanced Surgical Technology; University of Nebraska Medical Center, Omaha.

ISOLATION AND IDENTIFICATION OF ALKALINE LAKE BACTERIA. Luke Wright\*, Kathryn Score, Cristian Yanes-Salazar, and Ann Buchmann, Department of Physical and Life Sciences, Chadron State College, Chadron.

USING A STREAMBED TEMPERATURE SENSOR ARRAY TO STUDY HYPORHEIC FLOW IN CHADRON CREEK, NORTHWESTERN NE. Joseph J. Reedy\* and Michael Leite, Department of Physical and Life Sciences, Chadron State College, Chadron.

A ROBOTIC SYSTEM COUPLED WITH A TENSILE TESTING MACHINE TO MEASURE THE SURFACE PROPERTIES OF POLYMER SPECIMENS. Nguyen Thao Nguyen\* and Carl Nelson, Department of Mechanical and Material Engineering, University of Nebraska–Lincoln.

LEARNING ORGANIC REACTION MECHANISMS USING NSAIDS. Kathleen James\*, ShriHarsha Upplauri, and Ganesh Naik, Department of Chemistry, College of Saint Mary, Omaha.

AN OVERVIEW OF THE UNL SEPPO SCIENCE OUTREACH PROGRAM. Marina Bradaric\* and Sam Cajka, Department of Physics & Astronomy, University of Nebraska–Lincoln.

COLLEGE OF SAINT MARY ELEMENTARY SCIENCE OUTREACH PROGRAM. Kathryn Dearing\* and Kelly Lane\*, Department of Biology, College of Saint Mary, Omaha.

FEDEX CONNECTING THE WORLD. Colby Ranslem\*, Tyler Klingemann, and Cesar Zuluaga, Aviation Institute, University of Nebraska at Omaha.

INTEGRATING RESEARCH INTO THE CURRICULUM AT A SMALL COLLEGE. Elizabeth Arnason\*, Alexandra Egentowich\*, Katie James\*, Alica Newsome\*, and Brena Mauck\*, Department of Biology, College of Saint Mary, Omaha.

INSERTION PROCEDURES FOR SURGICAL ROBOTS. Tom Frederick, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln.

STEREOSCOPIC PAN-TILT CAMERA FOR SINGLE-INCISION ROBOTIC SURGERY DURING LONG-TERM SPACEFLIGHT. Jack Mondry\* and Shane Farritor, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln.

NASA USLI COMPETITION FOR UNL ENGINEERING STUDENTS. Matthew Mahlin, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln.

EMBEDDED MOTOR CONTROL OF A MINIATURE IN VIVO SURGICAL ROBOT. Joe Bartels, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln.

THE INTEGRATION OF IPAD TECHNOLOGY INTO STEM EDUCATION COURSEWORK. Neal Grangenett, Elliott Ostler\*, and Neal Topp\*, Department of Teacher Education; Robert Shuster\*, Department of Geography and Geology; Michael Matthews\*, Department of Mathematics; and Dana Richter-Egger\*, UNO Math and Science Learning Center, University of Nebraska at Omaha.

### ***ANTHROPOLOGY***

Co-chairpersons: Wayne A. Babchuk and Zachary H. Garfield

Department of Anthropology

University of Nebraska–Lincoln

Olin Hall 111

1:00 p.m.      WELCOME

- 1:15      1. LIFE ON THE EDGE: AN ARCHAEOLOGICAL INVESTIGATION OF THE UNSHELTERED IN LINCOLN. Alan Andersen\*, Kate Kollars, Rachel Soukup, Emily Spack, and LuAnn Wandsnider, Department of Anthropology, University of Nebraska–Lincoln.
- 1:30      2. FORENSIC ANALYSIS APPLIED TO THE ARCHAEOLOGICAL INVESTIGATION OF OLD BERNE MENNONITE CEMETERY. Jenny Hildebrand, Department of Anthropology, University of Nebraska–Lincoln.
- 1:45      3. THE PREHISTORIC CROCK-POT: REPLICATION OF A PIT-HEARTH. Chris Rowe, Department of Anthropology, University of Nebraska–Lincoln.

- 2:00 4. THERE ARE ROCKS AND THEN THERE ARE ROCKS! AN INTRODUCTION TO NATIVE AMERICAN LITHIC SOURCES AND USES. Mark J. Awakuni-Swetland, Department of Anthropology, University of Nebraska–Lincoln.
- 2:15 5. HISTORY OF EDUCATION AND REMOVAL OF NATIVE AMERICAN CHILDREN. Barbara Salvatore, Institute for Ethnic Studies/Native American Studies, University of Nebraska–Lincoln.
- 2:30 BREAK
- 2:45 6. HORSES, WARFARE AND SOCIAL REORGANIZATION: MACRO-LEVEL TRANSFORMATIONS OF PAWNEE SOCIETY DURING THE PRE, PERI AND POST CONTACT PERIODS. Amanda F. Callahan-Mims, Department of Anthropology, University of Nebraska–Lincoln.
- 3:00 7. DISPLAYS OF PERSONAL ADORNMENT AND BODY ART AS COSTLY SIGNALING: A CASE STUDY. Michelle Night Pipe, Department of Anthropology, University of Nebraska–Lincoln.
- 3:15 8. EATING AND OWNING “YOUR” FOOD: THE INTERCONNECTIONS OF DIABETES MELLITUS, THE INTELLECTUAL PROPERTY RIGHTS (IPRs) REGIME, AND NATIVE AMERICAN FOLK CROP VARIETIES. Mayo Buenafe, Department of Anthropology, University of Nebraska–Lincoln.
- 3:30 9. CULTIVATING SOCIAL-ECOLOGICAL COMMUNITY: A QUALITATIVE CASE STUDY EXPLORING SOCIAL-ECOLOGICAL RESILIENCE IN COMMUNITY GARDENS IN VIENNA, AUSTRIA . Joanna Chan, School of Natural Resources, University of Nebraska–Lincoln.
- 3:45 10. IMMIGRANT STUDENT EDUCATION: ANALYZING THE POTENTIAL. Kristine Sudbeck, Department of Anthropology, University of Nebraska–Lincoln.
- 4:00 11. TO SHAKE THE TRUTHFULNESS OF SCIENCE: A HISTORY OF ETHICS IN ANTHROPOLOGY. Heidi J. Paneitz and Steven J. Sarich, Department of Anthropology, University of Nebraska–Lincoln.
- 4:15 12. HOW THE PAST SHAPES THE PRESENT: EXAMINING DECISION MAKING USING AN EVOLUTIONARY PERSPECTIVE—ASSOCIATING FLUCTUATING ASYMMETRY AND CHOICE-BLINDNESS. Jackson S. Wagoner, Department of Anthropology; and Megan E. Hansen, School of Biological Sciences; and Rachel A. Coburn, Department of Biochemistry; and Katelynn Gonzalez, Department of Entomology, University of Nebraska–Lincoln.

## ***APPLIED SCIENCE AND TECHNOLOGY***

Chairperson: Mary Ettel  
Wayne State College, Wayne  
Olin Hall 325

8:10 a.m.      OPENING REMARKS

- 8:15      1.    HIGH-RESOLUTION MAPPING OF PLAYA WETLANDS WITH LiDAR. Yao Li\*, Nan Zhao , Zhenghong Tang, Department of Community and Regional Planning, College of Architecture; and Ruopu Li, School of Natural Resources, University of Nebraska–Lincoln.
- 8:30      2.    DEVELOPMENT OF LiDAR APPLICATION IN WETLAND RESOURCES MANAGEMENT. Yao Li, Department of Community and Regional Planning, College of Architecture, University of Nebraska–Lincoln.
- 8:45      3.    SIMULATION OF THE AREA-COVERAGE PROBLEM IN WIRELESS SENSOR NETWORKS. Ali Rezaeian\* and Azad Azadmanesh, Department of Computer Science, University of Nebraska at Omaha.
- 9:00      4.    DEVELOPING METHODS TO STUDY MAGNETICALLY CONTROLLED MOLECULAR MOTORS. Seth Dallmann\* and David Peitz, Department of Physical Science and Mathematics, Wayne State College, Wayne.
- 9:15      5.    PROGRESS IN THE MODERNIZATION OF THIN LAYER CHROMATOGRAPHY (TLC), USING ANODIZED ALUMINUM TO PRODUCE ALUMINA PLATES WITHOUT BINDERS. Alexis Sieh\*, Mary Ettel and David Peitz, Department of Physical Science and Mathematics, Wayne State College, Wayne.
- 9:30      BREAK
- 9:35      6.    DESIGN OF A LIGHTWEIGHT STEREOSCOPIC VIEWER FOR MINIMALLY INVASIVE TELE-OPERATED ROBOTIC SURGERIES. Jacob G. Greenburg, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln.
- 9:50      7.    EVALUATION OF INDIGENOUS OILS FOR THEIR POTENTIAL USES AS SUNSCREENS. Amber Kutnink\*, Katelyn Thiele and Darius Agoumba, Department of Physical Science and Mathematics (PSCM), Wayne State College, Wayne.

- 10:05      8. EVALUATION OF HEAT CONTENT IN DIFFERENT OILS AND BIODIESEL FUELS VIA CALORIMETRY. Evan Canning\*, Jake Janak, and Darius Agoumba, Department of Physical Science and Mathematics (PSCM), Wayne State College, Wayne.
- 10:20      9. MULBERRIES AS A HISTOLOGICAL STAIN: RESULTS FROM ANIMAL CELLS AND TISSUES. Carissa Wollman\* and Glenn E. Kietzmann, Department of Life Science, Wayne State College, Wayne.
- 10:35      10. UNDERGRADUATE RESEARCH IN MATHEMATICS. G. Griffith Elder, Department of Mathematics, University of Nebraska at Omaha.

### ***BIOLOGICAL AND MEDICAL SCIENCES***

Chairperson: Annemarie Shibata  
Department of Biology, Creighton University

#### **SESSION A**

Session Chairperson: Brad Ericson, University of Nebraska Kearney  
Olin 112

- 8:30      1. *IN VITRO* ELONGATION OF PORCINE EMBRYOS USING ALGINATE HYDROGELS AS A THREE-DIMENSIONAL EXTRACELLULAR MATRIX. Catherine N. Sargus\*, Sarah A. Plautz, and Angela K. Pannier, Department of Biological Systems Engineering, University of Nebraska–Lincoln; and Jeremy Miles and Jeff Vallet, USDA-ARS U.S. Meat Animal Research Center (USMARC), Clay Center.
- 8:42      2. EFFECT OF TIMP-2 ON NEURAL CREST PATHFINDING. Anne Elizabeth James\*, Alicia Muhleisen, and Mark V. Reedy, Department of Biology; and Philip R. Brauer, Department of Biomedical Sciences, Creighton University, Omaha.
- 8:54      3. MEASURING THE RATE OF NICOTINE UPTAKE IN DEVELOPING EMBRYOS. A.P. Akhter\* , J.H. Otto, D.A. Dobberpuhl , and M. V. Reedy, Creighton University, Omaha.
- 9:06      4. VALIDATION OF AN ENZYME IMMUNOASSAY TO MEASURE FECAL CORTICOSTERONE IN NESTLING RED-WINGED BLACKBIRDS (AGELAIUS PHOENICEUS). Michele Stretch\*, A. Hagstrom and L.M. Reichart, Department of Biology, University of Nebraska at Kearney.

- 9:18      5. INVESTIGATION OF THE PUTATIVE DNA MOTIF ASSOCIATED WITH T. GONDII BRADYZOITE INDUCTION. Sushrut D. Kamerkar\* and Paul H. Davis, Department of Biology, University of Nebraska at Omaha.
- 9:30      BREAK
- 9:45      6. SKELETOCHRONOLOGY RESULTS OF *LITHOBATES SPHENOCEPHALUS* FROM SOUTHERN FLORIDA. Megan Konz\* and J.E. Platz, Department of Biology; and L. Bruce, Department of Biomedical Sciences, Creighton University, Omaha.
- 9:57      7. ALIEN GENES: IS HORIZONTAL TRANSFER OCCURRING IN THE SIMULIIDAE? Alicia Unangst\* and the Simulium Genomics Consortium, Department of Biology, Creighton University, Omaha.
- 10:09     8. CHARACTERIZATION OF RED PIGMENTED BACTERIA FROM POTASH LAKES IN THE NEBRASKA SANDHILLS. Benjamin M. White\* and J.J. Shaffer, Department of Biology, University of Nebraska at Kearney.
- 10:21     9. DIFFERENTIAL GENE REGULATION OF THE *icaADBC* OPERON IN *STAPHYLOCOCCUS EPIDERMIDIS*. Riley Machal\* and Wendy P. Jamison, Department of Physical and Life Sciences, Chadron State College, Chadron.
- 10:33     10. ELUCIDATING THE MECHANISM FOR ABNORMAL GROWTH IN *TOXOPLASMA GONDII* IN VARIOUS U-2 OS CLONES COMPARED TO WILD TYPE. Steven V. Ready\*, Matthew Christenson, Andrew Trease, and Paul Davis, Department of Biology, University of Nebraska at Omaha.
- 11:00     MAIBEN MEMORIAL LECTURE - OLIN HALL B

### ***BIOLOGICAL AND MEDICAL SCIENCES***

#### **SESSION B**

Session Chairperson: Gary Duncan, Nebraska Wesleyan University  
Smith Callen Conference Center

- 8:30      1. A MAMMALIAN RIBOSWITCH IN THE SPERMINE BIOSYNTHETIC PATHWAY. Katie del Vecchio<sup>1</sup>\*, Molly McDevitt<sup>1</sup>, Jodi Monahan<sup>2</sup>, Garrett Soukup<sup>2</sup>, Julianne Soukup<sup>1,2</sup>, Departments of Chemistry<sup>1</sup> and Biomedical Sciences<sup>2</sup>, Creighton University, Omaha.



- 8:42      2. EFFECT OF MICRORNA-183 FAMILY ON EXPRESSION OF GENES THAT REINFORCE NEUROSENSORY CELL FATE IN THE INNER EAR. Zachariah Holmes<sup>1\*</sup>, Katie del Vecchio<sup>1</sup>, Jodi Monahan<sup>2</sup>, Chris Carlson<sup>1</sup>, Juliane Soukup<sup>1,2</sup>, Garrett Soukup<sup>2</sup>, Departments of Chemistry<sup>1</sup> and Biomedical Sciences<sup>2</sup>, Creighton University, Omaha.
- 8:54      3. STRUCTURAL CHARACTERIZATION AND ANALYSIS OF PRE-QUEUOSINE RIBOSWITCH. Christina Nguyen\*, Donald Schrack, and Juliane Soukup, Department of Chemistry, Creighton University, Omaha.
- 9:06      4. STRUCTURAL TRANSITIONS INDUCED BY MUTATIONS IN THE 5'NTR OF CVB3 GENOMIC RNA. Brooke L. Sullivan\* and William E. Tapprich, Department of Biology, University of Nebraska at Omaha.
- 9:18      5. USING *LACTOBACILLUS ACIDOPHILUS* AS A PROTECTIVE MEASURE AGAINST HIV INFECTION. Lucas T. Berke, University of Nebraska–Lincoln.
- 9:30      BREAK
- 9:45      6. GENOMIC ANALYSIS OF 11 ANTIGENIC MUTANTS OF THE *CHLOROVIRUS* PBCV-1. Garry Duncan\*, Department of Biology, Nebraska Wesleyan University, Lincoln; and David Dunigan, James Gurnon and James Van Etten, Department of Plant Pathology and Nebraska Center for Virology, University of Nebraska–Lincoln.
- 9:57      7. SYSTEMS ANALYSIS OF SIGNAL TRANSDUCTION NETWORKS IN BREAST CANCER DEVELOPMENT. Laura Allen, College of Arts and Sciences, University of Nebraska at Omaha.
- 10:09     8. ASSESSING CORRELATIONS BETWEEN LYNCH SYNDROM AND B-CELL CHRONIC LYMPHOCYTIC LEUKEMIA. Anthony Edholm\*, Department of Biology and Kristen M.Drescher, Department of Medical Microbiology and Immunology, Creighton University, Omaha.
- 10:21     9. STRUCTURE AND INTERACTION OF THE HUMAN HSP70-2 WITH PYRRHOCORICIN ANALOGS. Sasankh BC\*, University of Nebraska at Omaha; and Marcus P. D. Hatfield and Sándor Lovas, Department of Biomedical Sciences, Creighton University, Omaha.
- 10:33     10. EFFECTS OF WEIGHT REDUCTION ON LEPTIN SENSITIVITY IN DIET-INDUCED OBESE RATS. Curtis Perriotte-Olson\*, Chadron State College, Chadron; and Roger Reidelberger, and Alvin Haver, VA Research Service, VA Nebraska Western Iowa Health Care System, Omaha; and Department of Biomedical Sciences, Creighton

University, Omaha; and Bettye Apenteng, Department of Biomedical Sciences, Creighton University, Omaha; and James E. Blevins, VA Research Service, VA Puget Sound Health Care System, Seattle, WA; and Division of Metabolism, Endocrinology, and Nutrition, Department of Medicine, University of Washington School of Medicine, Seattle, WA; and Howard Fox, Department of Pharmacology and Experimental Neuroscience, University of Nebraska Medical Center, Omaha.

11:00 MAIBEN MEMORIAL LECTURE - OLIN HALL B

***BIOLOGICAL AND MEDICAL SCIENCES***

**SESSION C**

Session Chairperson: Julie Shaffer, University of Nebraska at Kearney  
Olin 112

- 1:00 1. TWO-PHOTON FLUORESCENCE INTENSITY AND LIFETIME IMAGING OF NADH REVEALS GLUCOSE AVAILABILITY IN CULTURED CELLS. L. V. Zholudeva\* and M. G. Nichols, Department of Physics; and R. Hallworth, Department of Biomedical Sciences, Creighton University, Omaha.
- 1:12 2. INTENSITY- AND LIFETIME-BASED ANALYSES OF ENDOGENOUS DIFFERENCES IN NADH METABOLISM IN COCHLEAR HAIR CELLS. K. G. Ward\* and M.G. Nichols, Department of Physics; and R. Hallworth and H. Jensen-Smith, Department of Biomedical Sciences, Creighton University, Omaha.
- 1:24 3. THE EFFECTS OF DYNAMIN-DEPENDENT ENDOCYTOTIC INHIBITION ON  $\text{Ca}^{2+}$  CHANNEL MOBILITY IN RIBBON SYNAPSES OF TIGER SALAMANDER RETINA. Matthew Shuman\* and W.B. Thoreson, Department of Ophthalmology, University of Nebraska Medical Center, Omaha.
- 1:36 4. DEVELOPMENT OF A WATER-SOLUBLE FLUORESCENT CHEMOSENSOR FOR DETECTION OF BIOLOGICALLY RELEVANT ANALYTES. Brent S. Bruck\* and James T. Fletcher, Department of Chemistry, Creighton University, Omaha.
- 1:48 5. DEVELOPMENTAL PLASTICITY OF METABOLIC RATE IN ORGANISMS WITH COMPLEX LIFE-CYCLES CAN CARRY OVER INTO ADULTHOOD. Chris Effken\* and C.M. Rauter, Department of Biology, University of Nebraska at Omaha.
- 2:00 BREAK
- 2:12 6. DEGENERATION OF AN ANCIENT RED ALGAL GROUP II INTRON. Jaicee A. Post\* and Dawn M. Simon, Department of Biology, University of Nebraska at Kearney.

- 2:24 7. SYNTHESIS AND ASSEMBLY OF DNA CONSTRUCTS FOR COMPLEMENTING MUTANTS DEFICIENT IN RNA INTERFERENCE IN GREEN ALGAE. Michael Stewart\*, Eun-Jeong Kim and Heriberto Cerutti, School of Biological Sciences and Plant Science Initiative, University of Nebraska–Lincoln.
- 2:36 8. EFFECT OF MANGANESE AND NITROGEN DEPRIVATION ON LIPID ACCUMULATION IN CHLAMYDOMONAS. Meagan N. Doyle\*, K.M. Musil, A.K. Barber, and P. Twigg, Department of Biology, University of Nebraska at Kearney.
- 2:50 9. INTERACTIONS OF HOPVI IN A TYPE THREE SECRETION SYSTEM. Meghan Smith\*, Department of Biology, Creighton University, Omaha; and Joe, J.R. Alfano, The Center for Plant Science Innovation, University of Nebraska–Lincoln.
- 3:02 10. TYPE III EFFECTORS OF *PSEUDOMONAS SYRINGAE* INDUCE A SECRETION-DEPENDENT REDUCTION IN HOST HISTONE H3 ACETYLATION. Troy P Hubbard\*, A. Karpisek, M. Jarecki, B.R. Jeong, J. Alfano, and K. van Dijk, Department of Biology, Creighton University, Omaha and University of Nebraska–Lincoln.

### ***BIOLOGICAL AND MEDICAL SCIENCES***

#### **SESSION D**

Session Chairperson: Annemarie Shibata, Creighton University  
Smith Callen Conference Center

- 1:00 1. FUNGAL DIVERSITY OF A COTTONWOOD ROOT SYSTEM. Jeff A. Shaw\*, Mary J. Harner and Dawn M. Simon, Department of Biology, University of Nebraska at Kearney.
- 1:12 2. ANTIBIOTICS FROM NATIVE PLANTS FOR USE AGAINST MRSA. Nisha Durand\*, Ann Buchmann, Joyce Hardy, Ron Weedon, and William Tuma, Chadron State College, Chadron.
- 1:24 3. IDENTIFYING GENETIC MECHANISMS RESPONSIBLE FOR LOSS OF PIGMENTATION IN *IOCHROMA CALYCINUM*. Rachel A. Coburn\*, Department of Biochemistry; and Stacey D. Smith, School of Biological Sciences, University of Nebraska–Lincoln.
- 1:36 4. A BUTTERFLY POPULATION CENSUS AT HITCHCOCK NATURE CENTER. R. Fukumoto\* and T. Burk, Department of Biology, Creighton University, Omaha.
- 1:48 5. THE DEVELOPMENT OF GRAPH THEORETIC TOOLS FOR ANALYZING AND VISUALIZING OF BIOLOGICAL DATA. Sasankh BC\* and Hesham Ali, College of Information Science and Technology, University of Nebraska at Omaha.

- 2:00 BREAK
- 2:12 6. DICER: CAN'T DANCE WITH OUT IT! Megan Bosch\*, Amanda Hake, and Annemarie Shibata, Department of Biology; and Marsha Pierce and Garrett Soukup, Department of Biomedical Sciences, Creighton University, Omaha.
- 2:24 7. NEUROTROPHIC EFFECTS OF MICROGLIA VIA ACTIVATION OF AKT SIGNALING AND EPIGENETIC MODIFICATION. Jing Chen\*, Irsa Shoiab, and Annemarie Shibata, Department of Biology, Creighton University, Omaha.
- 2:36 8. IMPACT OF OMEGA 3 AND OMEGA 6 FATTY ACIDS ON PS1, PS2, GFAP, AND NICAISTRIN LEVELS IN SPRAGUE DAWLEY RATS. Adam Dannehl\*, Nate Sindt, Martin Rodriguez, Samantha Lafontaine, Christina Hanson, and Janet Whitson, Department of Natural Science, Concordia University, Seward.
- 2:50 9. POLYMORPHIC A $\beta$  PROTOFIBRILS EXHIBIT DISTINCT CONFORMATIONAL DYNAMICS AS CALCULATED BY NORMAL MODE ANALYSIS. Matthew Armbruster\* and Patricia Soto, Department of Physics, Creighton University, Omaha.
- 3:02 10. BINDING MODES OF AGAAAAGA TO SYRIAN HAMSTER PRION PROTEINS. Ian P. Colling\*, Department of Biology; and Jason Bartz, Department of Medical Microbiology and Immunology; and Patricia Soto, Department of Physics, Creighton University, Omaha.
- 3:14 11. ANALYZING BIOLOGICAL NETWORKS USING GRAPH ALIGNMENT TOOLS. Kevin Chin\* and H Ali, College of Information Science and Technology, University of Nebraska at Omaha.
- 3:26 12. COMPARISON OF THE COXSACKIEVIRUS B3 VIRULENCE DETERMINING 5' NONTRANSLATED REGION STRUCTURE. Jerome Prusa, Department of Biology, University of Nebraska at Omaha.

## ***CHEMISTRY AND PHYSICS***

Chairperson:

Andy Zhong, Department of Chemistry, University of Nebraska at Omaha

### **SECTION A, CHEMISTRY**

Olin LH-A

8:00 a.m. WELCOME

- 8:05 1. AN INVESTIGATION OF THE DELIQUESCENT AND EFFLORESCENT PROPERTIES OF MIXED SODIUM CHLORIDE AND SODIUM SULFATE AEROSOLS USING INFRARED SPECTROSCOPY. Joshua P. Darr\*, Shannon Q. Stoffel, Yohei Kohno, and Kevin McKenna, Department of Chemistry, University of Nebraska at Omaha, Omaha.
- 8:20 2. STUDY OF PERMALLOY/BISMUTH/PERMALLOY NANOFUNCTIONS FOR SPIN VALVE DEVICES. Benjamin B. Wymore\*, and J. G. Redepenning, Department of Chemistry and A Sokolov, Department of Physics, University of Nebraska–Lincoln.
- 8:35 3. CRYSTALLINE  $\alpha$ -SAMARIUM SESQUISULFIDE SEMICONDUCTING NANOWIRES. Chris M. Marin\*, Lu Wang, Hsin-Yu Liu, Mike S. Thompson, Joseph R. Brewer, Wai-Ning Mei, and, Department of Chemistry, University of Nebraska–Lincoln; and Chin-Li Cheung Department of Physics, University of Nebraska at Omaha.
- 8:50 4. ENTRAPMENT OF NANOMATERIALS FOR USE IN HPLC AND FLOW-BASED ANALYSIS METHODS. Erika Pfaunmiller\* and David S. Hage, Department of Chemistry, University of Nebraska–Lincoln; and Stephen Gross, Department of Chemistry, Creighton University, Omaha.
- 9:05 5. KINETIC ANALYSIS OF THE CHEMICAL VAPOR DEPOSITION POLYMERIZATION (CVD) OF CYCLIC LACTONES INITIATED BY ZINC OXIDE (ZnO) USING A QUARTZ CRYSTAL MICROBALANCE (QCM). Kris Hiebner\* and Jody Redepenning, Department of Chemistry, University of Nebraska–Lincoln.
- 9:20 6. A SYNTHESIS OF PEROXIDE CONTAINING FATTY ACIDS. Jesse Joyce\*, Michael Richardson, and Patrick Dussault, Department of Chemistry, University of Nebraska–Lincoln.

- 9:35      7. UTILIZING PEROXIDES FOR NOVEL C-O BOND FORMATION. Benjamin W. Puffer\* and Patrick H. Dussault,\* Department of Chemistry, University of Nebraska–Lincoln.
- 9:50      BREAK
- 10:00      8. THEORETICAL STUDIES OF BINDING SITE HETEROGENEITY IN HIGH-PERFORMANCE AFFINITY CHROMATOGRAPHIC-BASED BIOINTERACTION STUDIES. Xiwei Zheng\* and David S. Hage, Department of Chemistry, University of Nebraska–Lincoln.
- 10:15      9. DO RELATIVE ACTIVATION ENERGIES PREDICT REGIOSELECTIVITY OF NUCLEOPHILIC AROMATIC PHOTOSUBSTITUTION REACTIONS? Gene G. Wubbels\*, Ryo Tamura, and Emmett P. Gannon, Department of Chemistry, University of Nebraska at Kearney.
- 10:30      10. GLYCOLATED ETHYNLARENES AS FLUORESCENT CHEMOSENSORS FOR THE DETECTION OF DIVALENT CATIONS. Audrey T. Gallagher\* and James T. Fletcher, Department of Chemistry, Creighton University, Omaha.
- 10:45      11. DETECTION OF FOOD OIL ADULTERATION USING ATR-FTIR WITH CHEMOMETRIC STRATEGIES. Grayson L. Jackson\*, Adam Zeiszler, Jiro Fujita, and David Dobberpuhl, Department of Chemistry, Creighton University, Omaha.
- 11:00      BREAK
- 11:00      MAIBEN MEMORIAL LECTURE - OLIN HALL B
- 1:00 p.m.      WELCOME
- 1:05      12. CHROMATOGRAPHIC ANALYSIS OF THE BINDING OF GLIBENCLAMIDE TO GLYCATED HUMAN SERUM ALBUMIN. Ryan E. Matsuda\* and David S. Hage, Department of Chemistry, University of Nebraska–Lincoln.
- 1:20      13. TRANSFORMATION OF PHARMACEUTICAL DRUGS IN THE PRESENCE OF WATER: EFFECT OF POLYMER ADDITIVES. Jacob. A. Hettenbaugh\* and A.D. Gift, Department of Chemistry, University of Nebraska at Omaha.
- 1:35      14. A FLUORESCENT SENSOR BASED ON 1,8-NAPHTHALIMIDE FOR F<sup>-</sup> SENSING. Chen Hou\*, Haishi Cao, Department of Chemistry, University of Nebraska at Kearney.

- 1:50 15. TANDEM REACTIONS INVOLVING REDUCTIVE OZONOLYSIS. Rachel Willand-Charnley\*, Shiva Kyasa Kumar, and Patrick H. Dussault, Department of Chemistry, University of Nebraska–Lincoln,
- 2:05 16. SYNTHESIS, BIOLOGICAL EVALUATION, AND MOLECULAR DOCKING STUDIES OF NOVEL PHOSPHOINOSITIDE-3-KINASE (PI3K $\alpha$ ) INHIBITORS. Dima A. Sabbah\*, Yuxiang Dong, and Jonathan L. Vennerstrom, College of Pharmacy, University of Nebraska Medical Center, 986025 Nebraska Medical Center, Omaha; and Neka A. Simms, and Michael G. Brattain, Eppley Cancer Institute, University of Nebraska Medical Center, 985920 Nebraska Medical Center, Omaha; and Edward L. Ezell, Eppley Cancer Institute, University of Nebraska Medical Center, 986805 Nebraska Medical Center, Omaha; and Haizhen Zhong, Department of Chemistry, University of Nebraska at Omaha.
- 2:20 17. NMR-BASED METABOLOMICS STUDY OF THE METABOLISM OF *STAPHYLOCOCCUS AUREUS* INFLUENCED BY DIFFERENT ENVIRONMENTAL FACTORS. Bo Zhang\*, Shulei Lei, and Robert Powers, Department of Chemistry; and Nagender Ledala, Rosmarie Gaupp, and Greg A. Somerville, School of Veterinary Medicine and Biomedical Sciences, University of Nebraska–Lincoln.
- 2:35 18. AN IMPROVED SYNTHESIS OF 4(5)-BENZYL-L-HISTIDINE. D. D. Smith\*, Department of Biomedical Sciences; and Audrey Gallagher, Wayne Gergens, Vincent Crowley, and Martin Hulce, Department of Chemistry; and Peter W. Abel, Department of Pharmacology, Creighton University, Omaha.
- 2:50 19. EXOCYCLIC ALLENES BY LITHIUM ALUMINUM HYDRIDE REDUCTION OF 3-TRIMETHYLSILYLETHYNYL-2-CYCLOALKENONES. John M. Kum, Andrew K. Urick, and Martin Hulce\*, Department of Chemistry, Creighton University, Omaha.
- 3:05 BUSINESS MEETING / BREAK
- 3:15 20. MEASURING THE METHANOL CONCENTRATION IN BIODIESEL USING NEAR-INFRARED SPECTROSCOPY. Kevin J. Kawa\*, B.A. Bialas, and A.D. Gift, Department of Chemistry, University of Nebraska at Omaha.
- 3:30 21. CHROMATOGRAPHIC APPROACH TO STUDY SULFONYLUREA DRUG BINDING TO HUMAN SERUM ALBUMIN IN DIABETES FOR PERSONALIZED MEDICINE. Jeanethe A. Anguizola\*, K.S. Joseph, Ryan Matsuda and David S. Hage, Department of Chemistry, University of Nebraska–Lincoln.
- 3:45 22. UNDERSTANDING METABOLISMS AND TOXICITIES OF TOP THERAPEUTIC DRUGS. Victoria Mashinson\*, Mengyi Zha, and Haizhen Zhong\*, Department of Chemistry, University of Nebraska at Omaha.

- 4:00 23. PREDICTION OF THE pK<sub>a</sub> OF SEVERAL CLASSES OF WEAK ACIDS FROM DFT STUDIES. Paul A. Karr\*, Jake Childers, Jake Janak, and Nathan Gerdes, Department of Physical Science and Mathematics, Wayne State College, Wayne.
- 4:15 24. IMPROVEMENT AND CATALYSIS OF METHANOL OXIDATION UTILIZING CERIA SUPPORTED PLATINUM. Elizabeth Needels\*, D.L. Jackson, and C.L. Cheung, Department of Chemistry and Nebraska Center for Materials and Nanoscience, University of Nebraska–Lincoln; and I. Gonzalo, L. Cunci, and C. Cabrera, Department of Chemistry and NASA-URC Center for Advanced Nanoscale Materials, University of Puerto Rico, San Juan, Puerto Rico 00936-8377.
- 4:30 25. INVESTIGATIONS INTO THE SYNTHESIS AND MECHANICAL PROPERTIES OF AN ORGANIC BONE/POLYGLYCOLIDE COMPOSITES. Lukasz Gauza\*, Chris Schwartz, Kris Hiebner and Jody Redepenning, Department of Chemistry, University of Nebraska–Lincoln.
- 4:45 26. IDENTIFICATION AND ANALYSIS OF THE PRODUCTS REMOVED FROM HUMAN FEET BY AN ELECTROLYSIS FOOTBATH. Erome Hankore\*, and Charles Freidline, Division of Science & Mathematics, Union College, Lincoln.
- 5:00 CLOSING COMMENTS

***CHEMISTRY AND PHYSICS***

Chairperson: Renat Sabirianov  
Department of Physics  
University of Nebraska at Omaha

**SECTION B, PHYSICS**

Planetarium

- 8:50 am WELCOME
- 9:00 1. ROSE ANALYSIS OF SHAPES. Benjamin Knutson, University of Nebraska at Omaha.
- 9:20 2. INDUCING MAGNETIZATION BY FLEXING GRAPHENE NANORIBBON. Nabil Al-Aqtash, University of Nebraska at Omaha.
- 9:40 3. FLUORESCENCE CORRELATION SPECTROSCOPY OF PROTEINS IN SUGAR SOLUTIONS. Nathan Holman\*, Yuli Wang, Michael Nichols, and David Sidebottom, Department of Physics, Creighton University, Omaha.



- 10:00      4. RECENT RESULTS FROM THE ALICE EXPERIMENT. Bjorn S. Nilsen, Department of Physics, Creighton University, Omaha.
- 10:20      5. EFFECT OF NITROGEN DOPING ON THE ELECTRONIC AND OPTICAL PROPERTIES OF TAON. F. Apostol\*, N. Al-Aqtash, Wai-Ning Mei, and R. Sabirianov, Department of Physics, University of Nebraska at Omaha.
- 10:40      6. DETECTION OF RHO MESONS IN ULTRA-PERIPHERAL HEAVY ION COLLISIONS. James Ross, Department of Physics, Creighton University, Omaha.

### ***EARTH SCIENCES***

Chair: Joseph Reedy

Department of Physical & Life Sciences

Chadron State College

Olin Hall 224

1:00 p.m.      OPENING REMARKS

- 1:05      1. INCORPORATING CLIMATE CHANGE INTO STATE DROUGHT PLANS. Joseph P. Robine\*, D. J. Bathke, and M. J. Hayes, National Drought Mitigation Center, Lincoln.
- 1:25      2. A STUDY OF NITRATE LEVELS IN CHADRON CREEK, NEBRASKA, USA. Abenezer Tadesse, Department of Physical and Life Sciences, Chadron State College, Chadron.
- 1:45      3. EFFECTS OF FIRE ON THE FERTILITY OF SOIL IN CHADRON NEBRASKA, USA. Zachary J. Brown, Department of Physical and Life Sciences, Chadron State College, Chadron.
- 2:00      4. PROTECTION FROM ELECTROMAGNETIC RADIATION THROUGH CLAY SOIL USED AS CONSTRUCTION MATERIAL. Ulrike J. Werner, Department of Math and Science, Oglala Lakota College, Kyle, SD.
- 2:20      5. SURFACE AND SUBSURFACE DISTRIBUTIONS OF URANIUM-BEARING STRATA IN NORTHWESTERN NEBRASKA AND SOUTHWESTERN SOUTH DAKOTA. Hannan E. LaGarry\* and Elisha Yellow Thunder, Department of Math and Science, Oglala Lakota College, Kyle SD.
- 2:40      6. VERTEBRATE-TRACK HYPOTHESIS FOR THE ORIGIN OF ENIGMATIC SEDIMENTARY STRUCTURES WITHIN EOLIAN CROSS-STRATA OF THE NAVAJO SANDSTONE AT ZION NATIONAL PARK, UTAH. David B. Loope\*, Vitaly A. Zlotnik, and Richard M. Kettler, Department of Earth and Atmospheric Sciences, University of Nebraska–Lincoln.

- 3:00 BREAK
- 3:10 7. REVISED LITHOSTRATIGRAPHIC CORRELATION OF THE ARIKAREE GROUP FROM NORTHWESTERN NEBRASKA TO SOUTHWESTERN SOUTH DAKOTA. Hannan E. LaGarry\*, Department of Math and Science, Oglala Lakota College, Kyle SD; and Jonathan D. Marcot, Department of Animal Biology, University of Illinois at Urbana-Champaign, Urbana IL; and David L. Fox, Department of Geology and Geophysics, University of Minnesota, Minneapolis MN; and Curtis Belile and Helene Gaddie, Department of Math and Science, Oglala Lakota College, Kyle SD.
- 3:30 8. NORTHWESTERN NEBRASKA LINEAMENTS CORRELATE TO FAULTS IN OUTCROP. Jennifer A. Balmat\* and Michael B. Leite, Department of Physical and Life Sciences, Chadron State College, Chadron.
- 3:50 9. MAPPING FAULTS IN SOFT-ROCK ENVIRONMENTS; THE PINE RIDGE OF NORTHWESTERN NE. Robert J. Boylan, Physical and Life Sciences, Chadron State College, Chadron.
- 4:10 10. A POSSIBLE SEISMIC SAND BLOW IN THE PINE RIDGE NEAR CHADRON, NE. T. J. Stunkel, Department of Physical and Life Sciences, Chadron State College, Chadron.
- 4:25 11. GROUNDWATER EXCHANGE ALONG FAULTS IN NORTHWESTERN NEBRASKA. Adam D. Neumann, Department of Physical and Life Sciences, Chadron State College, Chadron.
- 4:40 CLOSING REMARKS and SECTION MEETING

### ***HISTORY/PHILOSOPHY OF SCIENCE***

Chairperson: Claire M. Oswald

College of Saint Mary, Omaha

Olin 325

- 1:00 p.m. 1. DID DARWIN'S ORIGIN OF SPECIES HAVE A NEGATIVE IMPACT ON NATURAL THEOLOGY? Claire M. Oswald, Department of Biology, College of Saint Mary, Omaha.

### ***TEACHING OF SCIENCE AND MATH***

Chairperson: Julia Polak

Exeter-Milligan Public Schools, Exeter

Olin 325

- 1:20 1. USING AN INQUIRY APPROACH TO TEACHING THE SCIENTIFIC METHOD. Phyllis M. Higley, Department of Biology, College of Saint Mary, Omaha.
- 1:40 2. DESIGN AND IMPLEMENTATION OF INQUIRY-BASED RESEARCH PROJECTS TIED TO WRITTEN RESEARCH REVIEWS IN AN UNDERGRADUATE PHYSIOLOGY COURSE. Tessa L. Durham Brooks, Department of Biology, Doane College, Crete.
- 2:00 3. COMPUTER SIMULATIONS IN COLLEGE TEACHING. Abbi Placzek\*, C. Helmink, and J. Kren, Bryan LGH College of Health Sciences, Lincoln.
- 2:15 4. UTILIZING COMPUTER MODELING IN NURSING EDUCATION. Emilie Heitmann\*, K. Fox, S. Christ, and J. Kren, Bryan LGH College of Health Sciences, Lincoln.
- 2:30 5. MODELING PATHOLOGY OF PULMONARY SYSTEM. Tom Scdoris\*, L. Patterson, and J. Kren, Bryan LGH College of Health Sciences, Lincoln.
- 2:45 6. TEACHING MICROBIOLOGY LAB AS A RESEARCH BASED EXPERIENCE. Ann Buchmann, Department of Physical and Life Sciences, Chadron State College, Chadron.
- 3:00 7. LIVE BAT ENCOUNTER K-5 SCHOOL PRESENTATION. Melanie O'Brien, Parent/Volunteer, Lake Maloney Elementary, North Platte.

## **COLLEGIATE ACADEMY**

### **BIOLOGY**

Chairperson: Jeffrey Isaacson, Department of Biology  
Nebraska Wesleyan University, Lincoln

### **SESSION A**

Olin LH-B

- 8:00 a.m    1. ETHANOL AS A SECOND HIT FOR LIVER INJURY INDUCTION IN ETHANOL-FED HCV NS5A+ TRANSGENIC MICE. Jace D. Heiden\*, Department of Biology, Nebraska Wesleyan University, Lincoln; and J. Wagoner, R. Simpson, and N. Osna, Liver Study Unit, The Omaha Veterans Affairs Medical Center, the Department of Internal Medicine, University of Nebraska Medical Center, Omaha; and L. Poluektova, Center for Neurovirology and Neurodegenerative Disorders, Departments of Pharmacology and Experimental Neurosciences, Pathology/Microbiology and Internal Medicine, University of Nebraska Medical Center, Omaha.
- 8:12        2. INTERACTION BETWEEN CagZ AND THE GLOBULAR DOMAIN OF Cag5 IN THE PROCESS OF CagA TRANSLOCATION. Benjamin M. Wiese\*, G.A. Duncan, Department of Biology, Nebraska Wesleyan University, Lincoln; and D.A. Bonsor, Institute of Human Virology, University of Maryland—Baltimore, MD.
- 8:24        3. AN *IN VITRO* TRANSWELL SYSTEM SIMULATING THE PULMONARY MUCOSAL EPITHELIUM. Paul Williams\* and Therese McGinn, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 8:36        4. ACTIVATION AND MATURATION MARKER EXPRESSION IN KG-1 DENDRITIC-LIKE CELLS. Stacey L. Coufal\*, P.T. Williams, and T. McGinn, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 8:48        5. STANDARDIZATION OF MULTIPLEX REAL-TIME RT-PCR ASSAY FOR CONCURRENT BVDV-BRSV INFECTION. Jason S. Cameron\*, Department of Biology, Nebraska Wesleyan University, Lincoln; and C.L. Topliff, A.A.A. Alkheraif, and C.L. Kelling, School of Veterinary Medicine and Biomedical Sciences, Institute of Agriculture and Natural Resources, University of Nebraska—Lincoln.
- 9:00        6. METHYLATION STATUS OF N-CADHERIN PROMOTER SEQUENCE IN HUMAN BREAST CANCER CELL LINES: IMPLICATIONS FOR MOTILITY AND INVASIVENESS. Sarah Pracht\*, Nick Lukens\* and K.E. Marley, Department of Biology, Doane College, Crete.

- 9:12      7. EVALUATION OF N-CADHERIN PROTEIN EXPRESSION AFTER TREATMENT OF BT-20 HUMAN BREAST CANCER CELLS WITH METHYLATION INHIBITORS. Maire Rose Donnelly\*, M. Hruska, N. Lukens, S. Pracht and K.E. Marley, Department of Biology, Doane College, Crete.
- 9:24      BREAK
- 9:36      8. RECOVERY, PURIFICATION AND LABELING OF INLB AS A POTENTIAL DRUG DELIVERY AGENT. Trent Ahlers\*, Gustavo Zardeneta, Doug Christensen and Shawn Percy, Wayne State College Life Science Department, Wayne.
- 9:48      9. EFFECTS OF AMPRENAVIR ON EXPRESSION OF EPSTEIN – BARR VIRUS PROTEIN. Nathan Broeker\*, Douglas Christensen, and Shawn Percy, Department of Life Sciences, Wayne State College, Wayne; and Luwen Zhang, School of Biological Sciences, University of Nebraska–Lincoln.
- 10:00     10. ANTIBIOTIC RESISTANCE SCREENING VIA PCR IN/AROUND FEEDLOTS. Mitch Knudsen\* and Doug Christensen, Department of Life Sciences, Wayne State College, Wayne.
- 10:12     11. THE IMPACT OF THE “HURDLE EFFECT” ON ANTIBIOTIC RESISTANCE. Kaitlin Zentic\* and Doug Christensen, Department of Life Sciences, Wayne State College, Wayne.
- 10:24     12. CHARACTERIZATION OF ANTIBIOTIC RESISTANT BACTERIA FROM THE PLATTE RIVER. Alicia Newsome\* and B. Mauck, Department of Biology, College of Saint Mary, Omaha.
- 10:36     13. MICROBIAL COMMUNITIES IN RAINWATER HARVESTING SYSTEMS. Mallory L. Iseminger\*, Department of Biology, Nebraska Wesleyan University, Lincoln; and M. Pels, S. Bae, and M. J. Kirisits, Environmental Science Institute, University of Texas-Austin, Austin, TX.
- 11:00      MAIBEN MEMORIAL LECTURE, OLIN LH-B
- 12:00      LUNCH
- 1:00      14. TLR-3 EXPRESSION AND ACTIVATION OF NFκB, AND BRADFORD PROTEIN ASSAY WITH HUMAN BRONCHIAL EPITHELIAL CELLS. Sean D. Pauley\*, Betsy Barent, and Therese McGinn, Department of Biology, Nebraska Wesleyan University, Lincoln.

- 1:12 15. EVALUATION OF EXPRESSION OF PUTATIVE N-CADHERIN REGULATING TRANSCRIPTION FACTORS IN VARIOUS CELL LINES. Michael Hruska\*, M.R. Donnelly and K. E. Marley, Department of Biology, Doane College, Crete.
- 1:24 16. PRODUCING A METABOLIC FINGERPRINT FOR *ARABIDOPSIS THALIANA* PARENTAL LINES USING PROTON NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY. Autumn M. Longo\* and Tessa Durham Brooks, Department of Biology, Doane College, Crete.
- 1:36 17. LINKING MORPHOLOGY TO DIET IN THE PHYLLOSTOMINE BATS. Rachel V. Gibson\*, Erin E. Stukenholtz\*, and H. A. York, Department of Biology, Doane College, Crete.
- 1:48 18. EFFECTS OF LEAD ON PLANT GROWTH AND EVIDENCE OF TRANSLOCATION. Carolyn Behney\*, P. Higley, B. Mauck, J. Keyte, J. Chang, J. Karr, Department of Biology, College of Saint Mary, Omaha.
- 2:00 19. DISTRIBUTIONAL RECORDS OF LARGE BRANCHIOPOD SHRIMP (CRUSTACEA: *BRANCHIOPODA*) IN THE NEBRASKA SANDHILLS WITH NOTES ON HABITAT PREFERENCE. William E. Mausbach\* and Barbara Hayford, Department of Life Sciences, Wayne State College, Wayne.
- 2:12 20. PATHWAY ENRICHMENT OF CO-LETHAL NETWORKS. Kelsey Augustin\* and Kathryn Dempsey, Departments of Computer Technology, Information Systems, and Life Sciences, Wayne State College, Wayne; and Hesham Ali, College of Information Science and Technology University of Nebraska at Omaha.
- 2:24 BREAK
- 2:36 21. GENOTYPIC AND PHENOTYPIC CHARACTERIZATION OF *ULMUS PUMILA* (SIBERIAN ELM), *U. RUBRA* (RED ELM), AND THEIR HYBRIDS. Brandon J. Schlautman\*, Department of Biology, Nebraska Wesleyan University, Lincoln; and Juan E. Zalapa, USDA, Agricultural Research Service, Vegetable Crops Research Unit, Department of Horticulture, University of Wisconsin, Madison, WI; and Johanne Brunet, USDA, Agricultural Research Service, Vegetable Crops Research Unit, Department of Entomology, Madison, WI.
- 2:48 22. IDENTIFICATION OF THE QUORUM SENSING GENE IN *MYCOBACTERIUM SMEGMATIS* VIA TRANSPOSON MUTAGENESIS. Bri Dahlgren\*, Department of Biology, Nebraska Wesleyan University, Lincoln.

- 3:00 23. EVALUATION OF BIOFORGE AS AN APPLIED SEED TREATMENT TO PIONEER 93M11 SOYBEANS IN WAVERLY, NE. Kim Topil, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 3:12 24. THE EFFECT OF TRICLOSAN ON THE PROLIFERATION OF PERITONEAL TISSUE EXPLANTS IN CORRELATION WITH POST-SURGICAL WOUND HEALING. Megan M. Puckett\*, Department of Biology, Hastings College, Hastings.
- 3:24 25. GAPDH GENE ISOLATION, EXTRACTION AND SEQUENCING OF *OENOTHERA MACROCARPA*. Ashley M. Chalupa, Department of Biology, Chadron State College, Chadron.

### ***COLLEGIATE ACADEMY***

#### **BIOLOGY**

Chairperson: Jeffrey Isaacson, Department of Biology  
Nebraska Wesleyan University, Lincoln

#### **SESSION B**

Olin 249

- 1:00 1. ANALYSIS OF THE CRYSTALLIZATION OF MANNITOL AND THE SUBSEQUENT EFFECTS ON THE HUMAN BODY. Kailin K. Bellows\*, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 1:12 2. THE INDICATIONS OF THE VIDEO SWALLOW STUDY IN NEUROLOGICALLY NORMAL CHILDREN. Hannah Kinberg\*, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 1:24 3. EFFICIENCY OF RECREATIONAL WATER PURIFIERS ON CYANOTOXIN AND COLIFORM BACTERIA REMOVAL FROM SALT CREEK AND OAK LAKE OF LINCOLN, NEBRASKA. Matthew Anderson\* and Jerald Bricker, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 1:36 4. LOCOMOTOR PERFORMANCE FITNESS ADVANTAGE OF KLEPTOGENETIC MOLE SALAMANDERS (GENUS *AMBYSTOMA*). Garrett M. Janzen\*, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 1:48 5. THE EXTRACTION OF BIOACTIVE COMPOUNDS FROM POTENTIAL FUNGAL ENDOPHYTES. Lucas Hemmer\*, Department of Biology, Nebraska Wesleyan University, Lincoln.

- 2:00      6. BIOASSAYS OF FUNGAL ENDOPHYTES ISOLATED FROM BROMELIAD HOST PLANTS GROWING IN A NORTH-CENTRAL ECUADOR CLOUD FOREST. Capri Juilfs\*, Jerry Bricker, and Karis Overton, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 2:12      7. IDENTIFICATION OF BROMELIAD ENDOPHYTES FROM AN ECUADOR CLOUD FOREST USING ITS 1 AND 2. Rebeca Chavez Herrera\*, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 2:24      BREAK
- 2:36      8. LOSS OF ANTI-PREDATOR BEHAVIOR IN EASTERN FOX SQUIRRELS (*SCIURUS NIGER*) AFTER ISOLATION. Allison Connealy Neville\*, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 2:48      9. EVALUATION OF AQUAPORIN-3 EXPRESSION IN SALT, FRESH, AND BRACKISH WATER-ACCLIMATED SAILFIN MOLLIES (*POECILIA LATIPINNA*). Jaclyn R. Lange\*, G.W. Gerald, and T.M. McGinn, Department of Biology, Nebraska Wesleyan University, Lincoln.
- 3:00      10. DEVELOPMENT OF A SYSTEM TO DEplete Sir2 IN ORDER TO STUDY ITS ROLE IN MAINTAINING SILENT CHROMATIN AT THE RIBOSOMAL DNA LOCUS IN *SACCHAROMYCES CEREVISIAE*. Lindsey E. Jones\*, Department of Biology, Nebraska Wesleyan University, Lincoln; and Rachel Jordan, Interdisciplinary Graduate Program of Genetics, Texas A&M University, College Station, TX; and Mary Bryk, Department of Biochemistry and Biophysics, Texas A&M University, College Station, TX.



**COLLEGIATE ACADEMY**  
**CHEMISTRY AND PHYSICS**

Chairpersons: David Treichel and Nathaniel Fackler  
Nebraska Wesleyan University, Lincoln

**SESSION A**

Session Chairperson, David Treichel  
Olin 324

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| 9:00  | 1. PARTICLE IDENTIFICATION FOR PHI MESON PHOTOPRODUCTION IN ULTRAPERIPHERAL COLLISIONS AT RHIC. Barak R. Gruberg* and Janet Seger, Department of Physics, Creighton University, Omaha.                       |
| 9:12  | 2. PARTICLE IDENTIFICATION FOR ELECTRON-POSITRON PAIRS IN ULTRAPERIPHERAL COLLISIONS AT RHIC. Jarrod K. Bang* and J. Seger, Department of Physics, Creighton University, Omaha.                              |
| 9:24  | 3. OPTIMAL EXERCISE MODES FOR INDIVIDUALS WITH DIABETES. Cole Marolf*, Department of Physics, Nebraska Wesleyan University; and Judith Burnfield, Madonna Research Institute, Lincoln.                       |
| 9:36  | 4. MODIFYING JAVA SIMULATIONS OF BERNOULLI'S PRINCIPLE TO SIMULATE WIND TUNNEL AIR FLOW THROUGH A VENTURI. James Duin, Department of Physics, Hastings College, Hastings.                                    |
| 9:48  | 5. RECONSTRUCTION EFFICIENCIES FOR THE RHO AND J/PSI MESONS IN ULTRAPERIPHERAL COLLISIONS AT RHIC. Jhenieve Enriquez, Department of Physics, Creighton University, Omaha.                                    |
| 10:00 | 6. MEASURING POSITION AND TIME OF IMPACT OF IONS FORMED BY ELECTRON- MOLECULE COLLISIONS. Kiersten N. Mavis, and D. R. Sieglaff, Department of Physics and Astronomy, Nebraska Wesleyan University, Lincoln. |
| 10:12 | 7. VENTURI EFFECT AND ITS PRESENCE AT PEDESTRIAN LEVELS BETWEEN TWO LONG NARROW BUILDINGS. Raymond Hughey Jr, Department of Physics, Hastings College, Hastings.   |
| 10:24 | 8. RHO MESON YIELD AS A FUNCTION OF EVENT MULTIPLICITY IN ULTRAPERIPHERAL COLLISIONS AT RHIC. Jamison Duckworth (for the STAR Collaboration), College of Arts and Sciences, Creighton University, Omaha.     |
| 11:00 | MAIBEN MEMORIAL LECTURE, OLIN LH-B   |

**COLLEGIATE ACADEMY**  
**CHEMISTRY AND PHYSICS**

Chairpersons: David Treichel and Nathaniel Fackler  
Nebraska Wesleyan University, Lincoln

**SESSION B**

Session Chairperson, Nathaniel Fackler  
Olin 324

- 1:00 p.m. 9. RAYLEIGH INSTABILITY OF CHARGED LIQUID DROPLETS: WHERE A QUADRUPOLE TRAP AND MIE SCATTERING MEET. Neil Sabata, Department of Physics, Hastings College, Hastings.
- 1:12 10. GENERATING SIMULATIONS FOR THE  $J/\psi$  MESON IN ULTRA PERIPHERAL COLLISIONS AT STAR USING STARLIGHT. Gleb Batalkin, Department of Physics, Creighton University, Omaha.
- 1:24 11. NASCAR AERODYNAMICS. Colby Dolezal, Department of Physics, Hastings College, Hastings.
- 1:36 12. THE EFFECT OF THERMAL FLUCTUATIONS ON RESISTIVITY FOR THE HIGH-TEMPERATURE SUPERCONDUCTING FILM YBCO. Nick Tramp, Department of Physics, Hastings College, Hastings.
- 1:48 BREAK
- 2:00 13. ON THE GAS PHASE DEUTERATION OF 1-BUTENE. Nhu Le, Anne Mirich, and Bruce Mattson, Department of Chemistry, Creighton University, Omaha.
- 2:24 14. LIPID PEROXIDATION STUDIES IN COMMONLY USED COOKING OILS: CORELATION WITH POLYPHENOL CONTENT. Ana Laura Ortiz-Morales and Ganesh Naik, College of Saint Mary, Omaha.
- 2:36 15. PROGRESS TOWARD MODELING PEPTIDE-MINERAL INTERACTIONS IN BIOMINERALIZATION SYSTEMS USING ROSETTASURFACE. Adrian Draney, M.V. Wilson, and E. Wilson, Department of Chemistry, Doane College, Crete.
- 2:48 16. PREDICTION OF THE PKA OF SEVERAL CARBOXYLIC ACIDS FROM DFT STUDIES. Jake Childers\* and Paul A. Karr, Department of Physical Science and Mathematics, Wayne State College, Wayne.
- 3:00 17. LIPID PEROXIDATION STUDIES IN COMMONLY USED COOKING OILS: HPLC METHOD TO DETECT THE MALONDIALDEHYDE. Melina Baeza-Villa and Ganesh Naik, College of Saint Mary, Omaha.

# PROCEEDINGS

## AERONAUTICS AND SPACE SCIENCE

### SESSION A

#### PHOTOIONIZATION MODEL ANALYSIS OF X-RAY OBSERVATIONS: SEYFERT GALAXY NGC-4151

Adam Hester, Department of Physics, Creighton University, Omaha, NE 68178

We present an analysis, including photoionization modeling, of the intrinsic absorption in the Seyfert 1 galaxy NGC 4151 using spectra from the Chandra High Energy Transmission Grating Spectrometer in order to provide insight into the mass outflows from active galactic nuclei. Bearing in mind the 2006 results of Kraemer et al. simultaneous UV and X-ray analysis, we analyzed newer Chandra observations from March and July, 2007 in order to confirm conclusions regarding the nature of the absorption arising in a disk-driven wind. By generating 2x2 photoionization model grids in Cloudy (Ferland et al.) varying the Ionization parameter  $U$  as well as  $\log N_H$ , and through NASA's XSPEC X-ray spectral analysis, we fit power law models with absorption and reflection components to the Chandra data in order to understand the ionization observed.

#### VIEW OF AGN OUTFLOWS THROUGH THE MID-IR

Barbara Medvar and Jack Gabel, Department of Physics, Creighton University, Omaha, NE 68178

We present preliminary results of a study of the mid-infrared emission of broad absorption line (BAL) quasars to determine how they are related to the general population of quasars. We use the CLUMPY program code to create models of the tori that surround Active Galactic Nuclei. We compare these models to mid-infrared spectra of both BAL and non-BAL quasars obtained with the Spitzer Space Telescope. We specifically compare the inclination angle and the angular width of the torus for the two samples. We explore the physical meaning behind these results.

#### BROAD ABSORPTION LINES AND THEIR RELATION TO OTHER SPECTRAL FEATURES OF AGNS

Dan McGinnis, Department of Physics, Creighton University, Omaha, NE 68178

The infrared spectra of some active galactic nuclei (AGNs) exhibit broad absorption lines characterized by ionized gases moving at high velocities away from the central regions of these AGNs. It is unknown whether the presence of the mass outflows associated with the broad absorption lines represents a difference in the evolutionary stage of an AGN, or whether the phenomenon only occurs for certain orientations of the object. A preliminary test was performed to investigate the correlation between the presence of mass outflows and other spectral features which might indicate either evolutionary stage or orientation.

#### KINEMATIC VARIABILITY OF ABSORBERS IN THE SEYFERT 1 GALAXY NGC 3783

David Austerberry, Department of Physics, Creighton University, Omaha, NE 68178

Several epochs of spectroscopic observations of NGC 3783 have been made over the past decades. Recent data from Hubble's Cosmic Origins Spectrograph are analyzed to obtain the parameters determining the kinematics of broad absorbers. Multiple absorbing components have changed in velocity and strength. Models for kinetic luminosity measurements include independent covering factors for continuum and broad line emission sources. Weak absorption by CIII\* is used to

set a lower limit on number density. Together with ionic column densities, these parameters constrain photo-ionization models to determine the kinetic luminosity of the absorbers. The ratio of an outflow's kinetic luminosity to the bolometric luminosity of its quasar is of particular interest if it is above a level critical to galaxy growth and evolution. Prior observations have shown kinetic luminosities above the level necessary for significant feedback effects in numerical simulations of galaxy development. Models for the observed changes to absorber kinematics are compared.

#### EFFECTS OF MULTICOMPONENT DIFFUSION ON THE AUTO-IGNITION PHENOMENON WITH DETAILED CHEMICAL MECHANISMS

Inkant Awasthi and George Gogos, Department of Mechanical & Materials Engineering, University of Nebraska–Lincoln, NE 68588

Auto-ignition phenomenon is simulated with detailed chemical mechanisms and various approaches for multicomponent transport: (1) Unity Lewis number, (2) William's approximation, (3) Curtiss-Hirschfelder approximation, (4) William's approximation with zeroth order correction, and (5) full multi-component diffusion formula. Approaches (1-4) are approximations to approach (5) which is the comprehensive treatment of multicomponent transport. The effects of approximations (1-4) on auto-ignition are demonstrated by simulating unsteady, unstrained, reacting mixing layers of hydrogen-air and methanol-air. The findings indicate that, compared to the comprehensive treatment, results of approximation (1) differ significantly, whereas results of approximations (2-4) differ moderately.

#### THE INTEGRATION OF PROPANE FLAMING AND MECHANICAL CULTIVATION FOR EFFECTIVE CONTROL IN AGRICULTURE

Brian Neilson, Chris Bruening, and George Gogos, Department of Mechanical & Materials Engineering, University of Nebraska–Lincoln, NE 68588

The goal of flaming for weed control is to expose weeds to 800°C combustion gases for 0.1 seconds, heating the plant tissue so that cell walls rupture. The weed subsequently loses water and dies. Mechanical cultivation can also be used to control weeds in the inter-row space through the early part of the growing season. Neither method gives complete season-long weed control on its own, but when combined can be a very effective tool for non-chemical weed management. A hood and torch system was developed to be retrofitted on an existing row crop cultivator. Field studies were conducted in 2010 and 2011 to test the performance of the flamer/cultivator system. Visual weed control ratings in soybean reached 70% in 2010 and 75% in 2011 at 28 days after treatment. Gas temperature measurements were also conducted inside the flaming hood to quantify the advantages of a hood over an open torch.

#### ROBOTIC PLEURAL CATHETER INSERTION

Jeff Hawks, Department of Mechanical & Materials Engineering, University of Nebraska–Lincoln, NE 68588

The management of pneumothoraces is a clinical priority for the Lunar Outpost, ISS Contingency, and Outpost Contingency missions. The objective of this research is to develop an autonomous method for delivering a chest tube for pneumothorax management. While astronauts are given basic medical training, chest tube insertion can be difficult for a novice. Robotic chest tube insertion would decrease possible complications caused by using improper force and oversized incisions. Parameters such as insertion speed, repeatability, and the effect of variable tissue mechanics will be investigated through measurements from laboratory experiments during the prototype design process. A robust and reliable robot prototype will be designed, built, and tested experimentally to evaluate efficacy. This research is intended to serve as a preliminary study into the feasibility of autonomous chest tube delivery. Data gathered through these experiments are expected to lead to publications, further NASA collaboration, and funding for future projects.

## **IMPACT OF ENVIRONMENTAL DISTRACTION ON SKILLS PERFORMANCE DURING TELESURGERY: EFFECTS OF SURGICAL EXPERIENCE AND FATIGUE**

Ka-Chun Siu, Department of Environmental, Agricultural, and Occupational Health Science and Irene Suh, College of Public Health/Occupational Health & Center of Advanced Surgical Technology, University of Nebraska Medical Center, Omaha, NE 68198; and Michael Head and Carl Nelson, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln, NE 68588

This study investigated whether the impact of distraction on skills performance differed with surgical experience levels and to understand if such impact varied if performers experience fatigue. Fifteen participants (10 junior, 3 senior medical students, and 2 surgeons) were recruited to remotely perform a suturing task using a telesurgical robot under varied distractive environments. Time to task completion, total distance travelled, speed of movement and errors were recorded. Participants completed a questionnaire to indicate their fatigue levels. Spearman's correlations revealed that participants reported more fatigue when experiment was performed in the afternoon. More errors were noted in junior medical students who experienced higher level of fatigue, but not in experienced participants. Interesting, experienced participants increased their speed of movement without increasing errors when they experienced fatigue. While performing a telesurgical task under distractions, different performance strategies to cope with fatigue are found among participants with different levels of surgical experience.

## **MODULAR JOYSTICK DESIGN AND DISTRACTIONS IN VR SURGICAL SKILLS TRAINING**

Ka-Chun Siu, Department of Environmental, Agricultural, and Occupational Health Science, University of Nebraska Medical Center, Omaha, NE 68198; and Carl Nelson and Michael Head, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln, NE 68588

During space travel, tele-presence may be the only viable solution for surgical care. Manned missions may not have experienced medical staff on board to perform surgical procedures, or distractions may surround an on-board surgeon and impact his/her surgical performance. Therefore, a modular joystick has been developed and interfaced with a virtual reality (VR) based surgical training environment which can be customized to accommodate a variety of surgical simulations. It also tests two distraction criteria: how distractions affect surgical performance, and how the control interface of a robotic system affects surgeons' physical and mental fatigue. Often the design of the robot is the primary object in a project, and the control interface (e.g., joystick, exoskeleton, etc.) is a later addition. However, more care needs to be taken to avoid overly complicated and hard-to-use interfaces to insure optimal surgical performance. This project aims to develop the understanding of these barriers and their solutions.

## **RECENT PROGRESS ON MODRED – A MODULAR SELF-RECONFIGURABLE ROBOT SYSTEM FOR SPACE EXPLORATION**

S.G.M. Hossain and Carl Nelson, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln, NE 68588; and Prithviraj Dasgupta, Department of Computer Science, University of Nebraska at Omaha, NE 68182

Robotic technology is being applied to an increased extent for space exploration. Such technology needs to be robust and capable of multi-tasking in dynamically changing environments. With these goals in mind, a modular self-reconfigurable robot system was designed and developed that can maneuver through unstructured terrains common in planetary exploration. The developed robot system consists of two autonomous modules – each having four degrees of freedom, with a novel translational degree of freedom and docking interfaces to connect to other modules. The design procedure included

‘design for manufacture’ and ‘design for assembly’ practices. Each of the modules is equipped with sensors for navigation and detection of obstacles. The modules are also capable of communicating with each other using a radio communication system to enable untethered movements. Recent work includes the development of different types of locomotion gaits with multiple modules and enhancement of the inter-module docking feature.

#### DYNAMIC RECONFIGURATION IN MODULAR ROBOTS USING GRAPH PARTITIONING

Raj Dasgupta, Department of Computer Science; Vladimir Ufimtsev, College of IS&T, University of Nebraska at Omaha, NE 68182; and Carl Nelson, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln, NE 68588

In this presentation, we will describe the research on the ongoing NASA EPSCoR funded ModRED project. We will present our approach to solving the problem of dynamic self-reconfiguration by a modular self-reconfigurable robot (MSR) called ModRED. We have modeled the self-reconfiguration problem as a constrained optimization problem that attempts to minimize the reconfiguration cost while achieving a desirable configuration. We have represented the set of all robot modules as a fully-connected graph and used a graph partitioning technique to cluster the vertices (robot modules) together. We have verified our technique experimentally for different settings on a model of ModRED within the Webots simulator. Our results show that the graph clustering-based self-reconfiguration algorithm performs comparably with two other existing algorithms for clustering robot modules.

#### COMPLIANT GRASPING SYSTEMS FOR SPACE SURGERY

Alan Goyzueta and Carl Nelson, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln, NE 68588

The purpose of this project is to develop a passive compliant mechanism which will have the capability to grab and hold irregularly shaped objects inserted into it. The goal is to develop a compliant retention mechanism to achieve suitable grasping forces through the use of superelastic shape memory alloy materials and nonlinear finite element analysis. Different geometries of the superelastic material are explored to determine what provides the optimal combination of grasping force and insertion geometry compliance for surgical applications or, more generally, for other robotic applications which may be encountered in space exploration missions.

#### LIGHTWEIGHT TOOL HOIST FOR REDUCED GRAVITY SIMULATOR

Eric Markvicka, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln, NE 68588; and Larry Dungan, Thomas Cunningham, and Dina Poncia, ARGOS, Johnson Space Center, Houston, TX 77058

A fundamental and critical tool that has been used for years to help train and prepare astronauts and robotic systems for space exploration is reduced gravity simulators. Reduced gravity simulators have helped to predict results in unknown environments. Although, understanding a reduced gravity environment in current simulators is difficult. The Active Response Gravity Offload System (ARGOS) is being developed to allow the testing of robots, rovers, and humans in a simulated reduced gravity environment. ARGOS allows translation in all three axes, yaw, and limited pitch and roll. The system constantly offloads a specific force depending on the simulated environment. However, ARGOS is lacking the ability to offload instruments such as a coring drill during reduced gravity simulations, requiring larger forces than necessary. A lightweight tool hoist has been developed to improve the reduced gravity environment and simulations.

#### INVESTIGATING THE EFFECTS OF VARIOUS KINDS OF CHAOTIC AUDITORY STIMULUS ON THE WALKING PATTERNS OF BOTH HUMAN SUBJECTS AND A COMPUTER MODEL

Variability is present in human gait patterns. This gait variability is a deterministic outcome of a process that is dependent on a history of the past states. Healthy gait variability has been shown to contain mathematical chaos. As such, this chaotic gait variability yields to nonlinear analysis, analysis that considers the temporal structure of the time series of spatial and temporal parameters of gait. Chaotic gait variability has been found in more than human gait measures; it has been demonstrated in the gait patterns of simple passive walking models that are characterized by the absence of any muscular forces, where the energy for walking coming solely from gravity as they walk down a slope. This finding led to a series of human-based experiments that further demonstrated that the musculoskeletal mechanics play an important role in the structure of chaotic gait. However, this research has not linked the presence of chaos in gait variability with neural process, even though it has been shown that chaos is also present in the neural activation dynamics within our brains. Thus, the physiologically pertinent modeling of the sources of chaotic gait variability must include the interaction between a chaotic neural network model and the musculoskeletal mechanics. The current proposal will include creation of a neuromechanical model will be created by using a passive walking model interfaced with biologically inspired chaotic neural networks of various topological types. This model will be exposed to identical chaotic rhythms (chaotic rhythmic auditory stimulus) as in the human experiment. Its spatiotemporal parameters will be compared to spatiotemporal results of human experimental research in which subjects are exposed to identically rhythmic chaotic music. An extensive literature search found that no such modeling has ever been published before. This proposed experimental work will be of two parts. First, I will conduct human experimental research to investigate entrainment and synchronization of gait variability with chaotic music. Chaotic music of various generative mechanisms representing both the neural and mechanically-based sources of chaos will be normalized to the pace of subjects and played to them while they walk at their self-selected pace on a treadmill. Spatiotemporal gait parameters will be collected. This will allow the resolution of the nature and relative contributions to chaotic gait variability by: 1) the mechanics of the human body akin to a passive walker and 2) the chaotic dynamics generated by the neural networks in the brain. Second, I will investigate the biological plausibility of various models of the neural network topologies coupled to the passive walking model. These models will be designed to represent different graph-theoretical statistical quantities. Chaotic music will be created with different information-theoretical properties to elicit discernible results in the nonlinear analysis of gait variability in both the model and human subjects. The evaluation of the neural network topologies will be made through comparisons with the gait variability measures between the model and human subjects to find the minimal necessary and sufficient variable to model chaotic gait variability.

## EFFECTIVENESS OF AN ELASTIC LOAD-BASED EXERCISE PROGRAM IN IMPROVING BALANCE IN HEALTHY INDIVIDUALS

Jon Carey and Sara Myers, Nebraska Biomechanics Core Facility, University of Nebraska at Omaha, NE 68182

One consequence of space travel is the temporary loss of balance when returning to Earth. Upon return, astronauts' balance measures have deteriorated to levels found in the elderly population, due to loss of vertical orientation and muscle mass. NASA employs balance recalibration programs and continues to search for additional methodologies that may accelerate the re-adaptation process. This study proposes a novel use of elastic loading-based exercise as an additional method of balance recalibration for returning space travelers. Healthy adult subjects participated in an eight week elastic loading-based exercise program targeting both upper and lower body. Balance and postural control were measured at baseline and post-exercise intervention using the NeuroCom Balance Master to determine the band's training effect on balance and postural control. Significant improvement in balance measures was achieved over baseline measures. Elastic band based-training may be a valuable addition to existing balance recalibration strategies for returning space travelers.

## GAZE AND POSTURAL COUPLING TO VISUAL STIMULUS MOTION OF VARIOUS FREQUENCY STRUCTURE

Joshua L. Haworth, Srikant Vallabhajosula, and Nicholas Stergiou, Nebraska Biomechanics Core Facility, University of Nebraska at Omaha, NE 68182

We sought to test the characteristics of visual and postural system coupling in adults. Specifically we were interested in the sensitivity of coupling to the statistical complexity of the motion of a point-light stimulus. Participants were presented with four separate conditions, each defined by a different point-light stimulus defined to follow one of four signal structures; sine, chaos, surrogate, and brown noise. Each signal was comprised of 15,000 data points at 50 Hz, providing five minutes of continuous point motion. Gaze and posture were measures at 50 Hz. Correlation Dimension (representative of the number of active degrees of freedom) and Approximate Entropy (characterizes the structure of variability/regularity) properties were calculated to determine the responsive changes of visual and postural behavior. Results show sensitive responses of gaze and posture to the complexity structure of stimulus motion. This work suggests that entrainment of these systems is possible, even over complex input signals.

## DYNAMIC POSTURAL CONTROL USING THE LOCOMOTOR SENSORY ORGANIZATION TEST

Austin Davidson, Jun Hung Chen, Mukul Mukherjee, Sara Myers, Chun-Kai Huang, and Nicholas Stergiou, Nebraska Biomechanics Core Facility, University of Nebraska at Omaha, NE 68182; and Ka-Chun Siu, Department of Environmental, Agricultural, and Occupational Health Science, University of Nebraska Medical Center, Omaha, NE 68198

Successful locomotion relies on visual, somatosensory and vestibular sensory systems. Sensory conflicts occur when subjects encounter a perturbed environment. During periods of sensory conflict, characteristic postural control strategies are demonstrated. The Sensory Organization Test (SOT) is a validated assessment tool to detect sensory contributions to postural control during static standing. The objective of this study was to investigate Dynamic Postural Control (DPC) using the Locomotor Sensory Organization Test (LSOT). Performance was compared between the SOT and the LSOT. Compared to the static postural control, healthy individuals demonstrated worse DPC when the visual system was disturbed. The worst DPC was observed when subjects relied heavily on vestibular input. Subjects demonstrated significantly better DPC with faulty optic flow compared to no optic flow at all, indicating its importance. Preliminary data indicates it's feasible to test DPC during walking using the LSOT.

## EFFECTS OF ALTERED POTENTIAL ENERGY DURING GAIT: IMPLICATIONS OF CENTER OF MASS DISPLACEMENT IN SPACE FLIGHT

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Walking requires an efficient exchange between potential and kinetic energy to maintain an economical gait. Potential energy equals  $\text{mass} \times \text{gravity} \times \text{height displacement}$ . The effect of gravity to provide potential energy is compromised in microgravity, thus affecting the potential and kinetic energy exchange. This study used a novel curved treadmill that decreased the vertical displacement of the body's center of mass, thus reducing potential and kinetic energy exchange by affecting height displacement in the potential energy. We monitored metabolic cost of walking. Results confirmed our hypothesis, without the effective exchange between potential and kinetic energy, the body was required to perform increased kinetic energy which requires increased metabolic energy expenditure. We conclude that the altered potential energy in microgravity may result in an increased metabolic cost of walking.



## THE EFFECTS OF EXERCISE TRAINING ON ABNORMAL WALKING PATTERNS IN PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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Pulmonary function deconditioning is known to take place in astronauts exposed to microgravity. It leads to altered lung capacity for normal pulmonary functioning during spaceflight. People who suffer from chronic obstructive pulmonary disease (COPD) show oxidative stress that causes muscle atrophy, and previously we have indicated that altered walking patterns in COPD populations may result from physical inactivity. Therefore, it was our interest to explore if increased physical activity has an effect on COPD population's abnormal walking patterns. We recruited five subjects with COPD undergoing sixteen sessions of cardiorespiratory and resistance-training exercise. Each session lasted one hour at individual's 60-70% of peak work rate, and the average dosage of training was 2-3 times per week within seven weeks. Gait analysis was performed pre- and post-exercise, and both the kinematic and kinetic outcomes were examined using dependent t-tests. No difference was found for kinematic or kinetic outcomes. The lack of significant findings could be due to the small sample size or the insufficient training duration in length. In addition, it is possible that the heterogeneity in manifestations of COPD could also be a confounding variable. Future studies will use an adequately powered sample size to investigate the effect of an adjusted-training exercise on COPD population's abnormal walking patterns for improving pulmonary function in astronauts.

### **AERONAUTICS AND SPACE SCIENCE SECTION**

#### **SESSION B**

#### **AUTONOMOUS ROBOTICS**

Blake E. Ross and William Spurgeon, Department of Business and Information Technology, Western Nebraska Community College, Scottsbluff, NE 69361

Our goal is to program a radio-controlled (RC) car to autonomously navigate a predefined course. We chose to use an Arduino single-board microcontroller over other methods because it is quick to learn, easy to work with, and has the functionality needed. We are using the Arduino controller to interface with an off the shelf RC car. We give the car the sense of sight with the use of two ultrasonic sensors and its sense of position and navigation using an electronic compass and a GPS unit. We are processing real-time streaming GPS data. Samples of this data are used to determine position. We have learned how to work with the hardware and software side of navigating an object autonomously. Working on this project from scratch, tested and strengthened our learning capabilities, all while having fun!

#### **USING HIGH ALTITUDE BALLOON EXPERIMENT TO DETERMINE THE EFFECT OF NEAR-SPACE CONDITIONS ON SOUND**

Patricia Hanus, Department of Physics, Metropolitan Community College, Omaha, NE 68111

While sound has been studied extensively in close proximity to the ground in natural and controlled environments, less is known about the behavior of sound at high altitudes. This experiment includes data from two high altitude balloon flights. These balloons reached 81,000 feet and 85,000 feet, respectively. Sound was recorded for each flight and qualitatively assessed throughout its trip from the ground to near-space and back. Theoretically, sound, temperature, and air density should decrease as altitude increases. During the first balloon flight, temperature did not decrease as much as expected and, although it was difficult to ascertain due to apparent wind noises, sound intensity did appear to decrease

slightly. During the second flight, it was more apparent that temperature and sound intensity decreased. This investigation supports that sound is affected at high altitude as the physical forces of temperature and air density change act upon it.

#### THE NASA LUNABOTICS PROJECT

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This August, NASA's fourth rover will explore Mars. Autonomous exploration vehicles are invaluable to space exploration. As a first year team, our project is to build an autonomous robotic vehicle. This robot will compete in a simulated lunar environment at the NASA Lunabotics competition this May. NASA Lunabotics is a competition working towards extending and sustaining human activities across the solar system. Most importantly, this competition is helping to train the next generation of human space exploration. The design and construction of this robot will give members invaluable experience on the application of their coursework. It will provide them with a chance to work on a project and see a physical result, something that is lacking in the course curriculum. The Lunabot will measure 2.5 feet by 5 feet and the weight limit is 176 pounds. The robot needs to be capable of collecting and depositing at least 10kg of lunar regolith simulant. Our team's goals are to build a working, fully autonomous rover that can successfully navigate the competition's obstacles, collect a significant lunar simulant, and successfully deposit this simulant into the collection bins.

#### PROPELLANT SLOSHING STUDIES IN MICROGRAVITY

Carl Nelson, Eldon Summerson, Bethany Drain, Jake Reher, Eric Fritz, Jake Lewis, Lena Butterfield, Chase Blazek, Devin Bertsch, Joan Yule, and Matt Stroh, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln, NE 68588

Liquid sloshing, such as in propellant, can dynamically shift the center of mass of a spacecraft causing unstable flight trajectories. To mitigate this problem, propellant management devices (PMD) such as diaphragms are used to dampen sloshing forces. The goal of this study was to understand the fluid oscillation that occurs using an oblate spheroid tank geometry and a silicone rubber diaphragm with tank fill fractions of 49.09%, 76.49%, and 100% in microgravity, 1-g, and 2-g environments. Strain gauges mounted on the linear actuation device were used to measure the sloshing forces in the tank. It was seen that the fluid slosh response in microgravity often did not demonstrate harmonic oscillation behavior because the system seemed to be overdamped. Further testing is required in 0-g with appropriate diaphragm characteristics to understand the oscillation of fluid in microgravity using PMDs. Observations in 1-g and 2-g environments suggested a positively correlated trend between gravitational acceleration and natural frequency.

#### DESIGN BUILD FLY COMPETITION FOR UNL ENGINEERING STUDENTS

Kearney Lackas, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln, NE 68588

The Design-Build-Fly competition is an aircraft design competition held annually for engineering students. For this competition, students are asked to design an aircraft, build the aircraft using practical manufacturing methods, and fly this aircraft to demonstrate its flight characteristics. Cessna and Raytheon alternate hosting the competition and set new "mission" requirements each year corresponding to that company's facet of aerospace engineering. The University of Nebraska team is comprised of 8 mechanical engineering students. All 8 students have interest in Aerospace Engineering but are attending a college that does not offer this degree. This competition is the most valid aerospace experience available for UNL students. The aircraft is currently in its post-preliminary design phase and a prototype is being constructed. Flight testing will begin mid-February and the competition is held on April 13th.

## A COMPARISON OF ALTERNATIVES TO FORMALDEHYDE-CONTAINING FIXATION AND PRESERVATION SOLUTIONS

T'Essence Bessick, Department of Biology, College of Saint Mary, Omaha, NE 68106

Traditionally, tissue fixation and preservation is accomplished with a neutral buffered formalin solution, which kills most bacteria and fungi and fixes cells by cross-linking, effectively halting the decomposition of cells and tissue structure. However, formaldehyde is toxic both in solution and as a vapor and can cause major health and environmental issues. In addition to its toxicity, formaldehyde also has a very pungent smell and doesn't maintain life-like tissue properties. Alternatives to formalin were assessed with the goal of finding an alternative that met the following criteria: both fixative and preservative, less pungent odor, maintenance of life-like tissue properties, affordable and quality tissue preservation. Two alternatives were selected, Gylo-Fixx and Glutaraldehyde. Using normal saline as the control and standard formalin-based embalming fluid, a comparative analysis was done on beef liver and beef muscle to determine the best alternative to the standard. The goal is to transition from formaldehyde use at College of Saint Mary's cadaver lab and tissue preservation projects.

## FRACTURE CHARACTERIZATION OF ADHESIVELY BONDED CARBON/EPOXY JOINTS

Yi Hua, Ananth Ram Mahanth Kasavajhala, and Linxia Gu, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln, NE 68588

The objective of this work is to predict the fracture behavior of adhesive joints for the 4-ply carbon/epoxy lamina through finite element method. The influence of through-thickness flaw in the adhesive layer was examined. The contour integral method was used for evaluating the stress intensity factors (SIF) at the flaw tips, while the strength of the joint was assessed through the crack initiation and propagation simulation. The effect of adhesive shear modulus has also been investigated. Results suggested that the maximum stress occurred at the adhesive-adherend interface and increased stress levels were observed in the case of adhesive layer with flaw. It also highlighted distinct edge effects along the thickness of the adhesive joint. Compared to the perfect adhesive, the static strength of the adhesive joint with flaw remained unchanged. Large shear modulus of the adhesive diminished the strength of the adhesive joint with the increased SIF.

## ELECTRO DISCHARGE MACHINING (EDM) OF ADVANCED MATERIALS FOR AEROSPACE APPLICATIONS

K.P. Rajurkar, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln, NE 68588

Titanium and its alloys (e.g., Ti6Al4V) are important engineering materials in aerospace, medical and many other industries; but are also difficult-to-machine materials by conventional machining processes (such as turning and milling). This paper reports recent results of an experimental study conducted to understand the effect of machining parameters on the machining stability and machining performance such as material removal rate (MRR), tool wear ratio (TWR) and the surface quality of titanium alloys machined with Electrical Discharge Machining (EDM). A brief literature review on the technical achievements about machining the typical titanium alloy—Ti6Al4V with electrical discharge machining (EDM) and Wire Electrical Discharge Machining (WEDM) processes is also reported.

## CHARACTERIZING THE MODIS AEROSOL DATA QUALITY FOR COASTAL REGIONS

Jacob Anderson and Jun Wang, Department of Earth and Atmospheric Sciences, University of Nebraska–Lincoln, NE 68588

The Moderate Resolution Imaging Spectroradiometer (MODIS) sensors—on board both Terra and Aqua satellites—provide an estimate for the global aerosol distribution. MODIS utilizes multiple aerosol algorithms, Dark-Target Land, and Over-Ocean. Thus, it can retrieve multiple values for Aerosol Optical Depth (AOD) over coastal regions. The algorithms from MODIS are evaluated through comparison with Aerosol Robotic Network (AERONET) stations to determine which algorithm performs best for coastal areas. Using Aerostat Giovanni (<http://giovanni.gsfc.nasa.gov/aerostat/>) a difference between the MODIS algorithms is revealed for coastal sites. In coastal regions the Over-Ocean algorithm is limited by the surface characteristics assumed in the AOD calculations, leading to an overestimation of AOD by 0.016 for events less than 0.25 and an underestimation of AOD by 0.039 for events greater than 0.25. Furthermore, the Dark-Target Land algorithm overestimates AOD near the coast by 0.027 over the full range of AOD events.

#### **SATELLITE REMOTE SENSING OF VOLCANIC ASH PLUMES: CASE STUDIES AND METEOROLOGICAL INTERPRETATIONS**

Collin Holmquist and Jun Wang, Department of Earth and Atmospheric Sciences, University of Nebraska–Lincoln, NE 68588; and Olga Kalashnikova, NASA Jet Propulsion Laboratory, Pasadena, CA 91109

The use of satellite imagery to observe volcanic eruptions is pertinent to analyzing the resulting ash plume. Ash plume heights and chemical content are important for understanding the effects a plume has on the atmosphere. To aid in the study of the ash plumes, the imagery of the Multi-angle Imaging SpectroRadiometer (MISR) and the Moderate Resolution Imaging SpectroRadiometer (MODIS) can be used in synchronously with computer programs to analyze height and reflectance/absorption properties. In turn the results can be used with transport and climate models to analyze the meteorological impacts of the ash plume.

#### **ASSESSMENT OF PARTICULATE MATTER, SCATTERING COEFFICIENT, AND AEROSOL OPTICAL DEPTH IN BALTIMORE, MD FOR AIR QUALITY STUDIES**

Samantha Strong-Henninger, Jun Wang, and Amy Gehring, Department of Earth and Atmospheric Science, University of Nebraska-Lincoln, NE 68588

To further understand air quality in the Baltimore, MD region, this study compares and assesses particulate matter (PM), scattering coefficient (bscat), and aerosol optical depth (AOD) data from various instrumentation for the year 2010. Data for this study was collected by the UMBC Monitoring of Atmospheric Pollution (UMAP), and contains AOD data from the Aerosol Robotic Network (AERONET), PM data from the Tapered Element Oscillating Machine (TEOM), and bscat data from the Nephelometer. AOD data from the Moderate Resolution Imaging Spectroradiometer (MODIS) will also be used. Although these instruments measure different variables, previous findings show that there is a good correlation between AOD and PM<sub>2.5</sub> as well as between AOD and scattering coefficient values. Analysis of UMAP data confirmed a good, positive correlation between all variables. This study suggests that air quality measurements can be assessed from either AOD, PM, or bscat data.

#### **REMOTE SENSING OF SURFACE VISIBILITY IN BALTIMORE, MARYLAND**

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In this study, we evaluate whether remote sensing techniques can help to determine surface visibility. AOD measurements from the MODerate Resolution Imaging Spectroradiometer (MODIS) will be compared with one-minute extinction coefficient (visibility = 3.0/bext) data from the Automated Surface Observing System (ASOS). However, since ASOS data lack quality control regulations, we first develop methods for quality control, including steps to limit unrealistic variability, poor calibration,

and inconsistent formatting. Then, we test different protocols for spatial averaging of the MODIS data (1x1, 3x3, and 5x5 pixels) against temporal averages of the ASOS data ( $\pm 15$ ,  $\pm 30$ ,  $\pm 60$ , and  $\pm 90$  minutes) to collocate and compare the two datasets for the Baltimore, MD region. Once correlations are developed, two different methods incorporating the Goddard Earth Observing System Model Version 5 (GEOS-5) planetary boundary layer height (PBLH) and surface extinction data are applied to account for aerosol distribution in the atmosphere.

#### MESOSCALE MODELING OF SMOKE TRANSPORT AND RADIATIVE IMPACT OVER THE SOUTHEAST ASIAN MARITIME CONTINENT

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The online-coupled Weather Research and Forecasting model with Chemistry (WRFchem) is used to simulate the transport and radiative impact of smoke particles over the Southeast Asian Maritime Continent during September – October 2006 when the largest regional biomass burning outbreak since 1997. The modeled smoke transport pathway is found to be consistent with the MODIS true color images and measured mass concentration of surface PM<sub>10</sub>. The interplay of sea/land breezes, typhoons and storms over the subtropical western Pacific Ocean, trade winds, and topographic effects, can be clearly seen in the model simulation. Smoke radiative impact on surface energy budget, the change of vertical circulation were studied by numerical experiment under different OC (Organic Carbon) /BC (Black Carbon) ratio and different mixing rule of aerosols.

#### ASTER MINERAL SPECTRAL INDICES APPLIED TO GEOLOGICAL MAPPING OF THE CHADRON DOME, DAWES COUNTY NEBRASKA

Steven Welch and Michael Leite, Department of Physical and Life Sciences, Chadron State College, Chadron, NE 69337

Remote sensing data from the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) instrument aboard NASA's Terra Spacecraft was investigated as a method to differentiate and map surface lithologies of the Chadron Dome in northeastern Dawes County, Nebraska. We applied spectral indices developed by other workers at Cuprite, Nevada. These indices were intended to extract spectrophotometric signatures of alunite, calcite, kaolinite, and montmorillonite from ASTER's five short-wave infrared (SWIR) bands. Preliminary results suggest this technique is not easily transferrable to areas of high vegetation density with limited outcrops. Vegetation masking using ratio transformations of Landsat Thematic Mapper bands decreased noise and removed regions of unusable information. We are experimenting with additional GIS methods to further refine the results.

#### A COMPARISON OF THREE VEGETATION INDICES FOR ESTIMATING GREEN LEAF BIOMASS IN A RAIN-FED CORN AND SOYBEAN FIELD ACROSS MULTIPLE GROWING SEASONS

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Measuring biomass in crops is important for yield prediction, nutrient management and carbon sequestration analysis. Remote sensing techniques, as an alternative to traditional in situ sampling methods for biomass assessment, provide potentially more efficient data acquisition and cost-effective

procedures. Numerous vegetation indices (VI) have been developed which use spectral reflectance data from vegetation to measure plant biophysical characteristics. The aim of this research was to compare three VIs for predicting the biomass of corn and soybeans in a rain-fed field. Thirty-two 2-meter digital aerial images acquired by the AISA-Eagle remote hyperspectral sensor, during the 2002 – 2007 growing seasons, were analyzed for this purpose. The VIs used were Normalized Difference Vegetation Index (NDVI), Red-Edge Chlorophyll Index (CI<sub>Red-Edge</sub>) and Wide Dynamic Range Vegetation Index (WDRVI). VI versus biomass R<sup>2</sup> values ranged from 0.71 – 0.98, with WDRVI having the highest overall correlation for all study years.

#### FIELD-SCALE ESTIMATION OF GREEN LEAF AREA INDEX USING AIRBORNE HYPERSPECTRAL IMAGES ACQUIRED OVER CORN AND SOYBEAN FIELDS

Tarlan Razzaghi, Anatoly Gitelson, Donald Rundquist, T.J. Arkebauer, Y. Peng, and A.L. Nguy-Robertson, Center for Advanced Land Management Information Technologies, School of Natural Resources and Department of Agronomy and Horticulture, University of Nebraska–Lincoln, NE 68588

Green leaf area index (green LAI) is a measure of vegetative growth and development, and it is frequently used as an input parameter for yield estimation, modeling crop productivity, and evapotranspiration models. Extensive destructive sampling is usually required to achieve accurate estimates of green LAI. However, this method is costly, time-consuming, and labor intensive, and as such, the procedure can only be used on small experimental plots. Remote sensing techniques, on the other hand, can provide fast, up-to-date and relatively inexpensive data acquisitions over large geographic areas. For this study, hyperspectral Airborne Imaging Spectrometer for Applications (AISA) imagery, acquired at 3 meter spatial resolution in 36 bands, was used. The main objectives of this study are: 1) to estimate green LAI in corn and soybean fields by using hyperspectral images; and 2) to map the spatial and temporal distribution of green LAI during the growing season of 2004. Eight spectral vegetation indices, NDVI, Red edge NDVI, Green NDVI, Simple ratio, EVI2, MTCI, CI red edge and Wide Dynamic Range Vegetation Index (WDRVI) were extracted from the imageries and mapped. The empirical relationship between the measured green LAI, obtained from sampling zones, and the spectral indices were analyzed through regression models to derive algorithms for estimating green LAI. The best algorithms were then applied to the AISA image to generate high spatial resolution (3m) maps of green LAI distribution for each crop type. NDVI-like vegetation indices showed low sensitivity to green LAI higher than 3, except Red edge NDVI that illustrated a nonlinear relationship in corn. The results indicate that the highest linear correlation and sensitivity occurred in the WDRVI-based model for corn (R<sup>2</sup>= 0.95), and CI red edge-based model for soybean (R<sup>2</sup>= 0.87). Other empirical models gave coefficients of determination in a range between 0.82 and 0.98 for each crop type. The high resolution airborne remote sensing proved to be a powerful tool for estimating green LAI at field scale, which assists agriculturalists in making well-informed management decisions.

#### USING COMBINED VEGETATION INDICES TO IMPROVE SENSITIVITY TO THE REMOTE ESTIMATION OF GREEN LAI IN CROPS

Anthony L. Nguy-Robertson, Anatoly A. Gitelson, Yi Peng, and Donald Rundquist, Center for Advanced Land Management Information Technologies, School of Natural Resources; Timothy J. Arkebauer, Department of Agronomy and Horticulture, University of Nebraska-Lincoln, NE 68588; and Andres Vina, Center for Systems Integration and Sustainability, Michigan State University, East Lansing, MI 48824

Green leaf area index (gLAI) is an important biophysical characteristic used in climate, ecological, and crop yield models. There is a need for a rapid and accurate estimation of gLAI on a global scale. Traditionally used vegetation indices (VIs) have shown to saturate at moderate-to-high gLAI (e.g. NDVI) or are less sensitive to gLAI at low-to-moderate values of gLAI. The goal of this study was to determine the best suitable VIs for use in a combined vegetation index for estimating gLAI

in crops in the entire dynamic range of gLAI from 0 to more than 6 m<sup>2</sup>/m<sup>2</sup>. The study area consisted of three fields in eastern Nebraska, USA under different management conditions for the years 2001-2008 for a total of 24 field-years. NDVI-like indices were the most sensitive to gLAI below 3 m<sup>2</sup>/m<sup>2</sup> while Simple Ratio (SR) and the Chlorophyll Indices (CI) were more sensitive to gLAI above 3 m<sup>2</sup>/m<sup>2</sup>.

#### IRON OXIDE CEMENTS AS MICROBIALLY-INDUCED SEDIMENTARY STRUCTURES

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The search for carbon-based biomarkers is complicated by the instability of these molecules in planetary regolith and by ubiquitous contaminants. We propose that many iron-oxide cements are microbially-induced sedimentary structures (MISS) - features that could facilitate planetary exploration if present on other planets. We have identified and described a number of iron-oxide MISS. These include rinded iron-oxide concretions (Navajo SS; Utah), “rattlestones” (Dakota Fm; Nebraska) and so-called “Wonderstone” (Chinle Fm; Utah). We consider these occurrences products of the microbial oxidation of siderite. Siderite (FeCO<sub>3</sub>) forms during carbonatization of ferrous silicates (as well as in numerous other terrestrial settings). Siderite is, however, stable only under reducing conditions. Under conditions present on Mars, siderite will oxidize to goethite, yielding -85 kJ per mole of siderite (a value well in excess of the -30 kJ obtained from the hydrolysis of ATP). We are testing our hypothesis with combined field, petrographic and isotopic work.

### **AERONAUTICS AND SPACE SCIENCE**

#### **POSTER SESSION**

#### THE EFFECT OF EXERCISE TRAINING ON QUALITY OF LIFE IN PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE

Jennifer Yentes, Chun-Kai Huang, and Daniel Blanke, Nebraska Biomechanics Core Facility, University of Nebraska at Omaha, NE 68182

Astronauts suffer from extreme muscle wasting and weakness from unloading and disuse during spaceflight. This is due partly from reduced gravity but also a lack of physical activity, which has a high impact on one's quality of life. Similar muscle wasting and weakness results from oxidative stress in patients with chronic obstructive pulmonary disease (COPD), and who also report a decreased quality of life and activity levels. Therefore, COPD patients can serve as a model for rehabilitation techniques used to increase quality of life in astronauts. Five subjects with COPD underwent sixteen sessions (two to three per week) of cardiorespiratory and resistance-training exercise monitored by a fitness professional. Each session lasted one hour in length and was customized to each individual's strength and endurance levels; however, each subject performed the same exercises. Lung function was quantified through spirometry, forced expiratory volume in one second and forced vital capacity. Quality of life was calculated from the total score of the St. George Respiratory Questionnaire (SGRQ). The SGRQ is divided into three parts (symptoms, activity, impacts) and a total score. Subjects were tested pre- and post-intervention. Group means were subjected to dependent t-tests. Lung function did not demonstrate a significant change. No difference was found for any of the four scores from the SGRQ pre- and post-intervention. The lack of significant findings could be due to the extremely high variability (i.e. standard deviation) present within the subjects. These findings not only provide us with preliminary data to calculate an adequately powered sample size, but also show the potential improvement in forced vital capacity to astronauts post-intervention. Another explanation for the lack of significant findings could be due to the different dosage of the training program. All subjects completed the same exercises; however, the resistance amounts varied based upon the subject's abilities.

## DESIGN OF ANKLE EXOSKELETON FOR CALF MUSCLE WEAKNESS

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Long term duration in zero and microgravity conditions results in muscle atrophy. The calf muscles in particular are drastically affected, resulting in decreased torque and power output at the ankle during walking. This proposal is the continuing development of an exoskeleton to be worn on the lower leg to assist with power output at the ankle in late stance. The prototype has been further developed from the first model. The exoskeleton consists of an electromagnetic clutch system designed to engage at heel strike during walking. The clutch system locks the proximal attachment point of a pneumatic spring. As the tibia progresses forward the spring extends, capturing spring potential energy. In late stance the spring recoils, increasing power output at the ankle during push-off. All work thus far has been bench work, human testing is expected in the near future.

## REDUCING THE IMPACT OF DISTRACTION ON REMOTE SURGICAL SKILLS LEARNING IN TELEMEDICINE

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Distractions are recognized to negatively affect surgical skills performance. The role of feedback in counteracting such negative effect was investigated. Thirty-three participants were randomly assigned into 3 training groups: outcome feedback (OFD), process feedback (PFD) and control, and performed a knot tying task with the Da Vinci Surgical System. PFD was provided while watching previously recorded performance whereas OFD was given based on the actual performance. Participants were exposed to three distractions during training: passive, active and interactive. Time to task completion, total distance travelled of the task performance and errors were measured before, after and 2-week after training. The two-way ANOVA indicated that significant differences were found in all measures after training and the differences were sustained after 2 weeks ( $p < 0.001$ ). The significant feedback effect showed that PFD was more prominent in minimizing the effect of distraction ( $p < 0.05$ ). Process feedback could be useful to enhance skills learning in telemedicine.

## ISOLATION AND IDENTIFICATION OF ALKALINE LAKE BACTERIA

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Southwestern Nebraska is dotted with hundreds of alkaline lakes, ranging from pH 9-11. The bacteria that grow in these lakes have adapted to the alkaline conditions and are alkalitolerant (able to live in both alkaline and more neutral environments) or alkaliphilic (adapted to live only in alkaline environments). The purpose of this study was to identify alkaliphilic bacteria and to eventually study the adaptations these bacteria have made in order to survive in an alkaline environment. Water and soil samples were collected from a pH10.5 pond just south of Antioch, NE. Bacteria were then grown on plates of defined media at pH 7, pH 9, and pH 11. Bacteria that could grow at pH 9 or pH 11 but not at pH 7 were considered to be alkaliphilic. The genomic DNA from these bacteria was harvested and amplified in PCR reactions using the universal bacterial primers for 16S rDNA. This amplified DNA was then sequenced in an attempt to identify the alkaliphilic bacteria. The population structure of bacteria were also examined using denaturing gradient gel electrophoresis, which produces individual bands on a DNA gel with each band representing a species of bacteria. In addition, the chemical components of soil and water samples were measured using standard techniques. A comparison between the chemical and biological components of the lakes will be discussed.

## USING A STREAMBED TEMPERATURE SENSOR ARRAY TO STUDY HYPORHEIC FLOW IN CHADRON CREEK, NORTHWESTERN NE



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In an effort to further define and understand groundwater-surface water interaction in situ temperature sensor arrays were installed in two 500m reaches of Chadron Creek. Individual sensors were installed approximately 10m apart at a depth of approximately 20cm in the streambed. The sensors were programmed to record the streambed temperature every 5 minutes for a period of about 20 days. The data were analyzed to determine statistics such as minimum, maximum, and range. The results indicate that effluent reaches have suppressed diurnal temperature cycles as compared to non-effluent reaches. Utilizing in situ temperature sensors appears to be a cost effective way to determine reaches of high exchange and ground water influence. Additional research needs to be conducted to understand the effects streambed heterogeneity and surficial features exert on streambed temperature variation as determined using single sensor arrays.

#### A ROBOTIC SYSTEM COUPLED WITH A TENSILE TESTING MACHINE TO MEASURE THE SURFACE PROPERTIES OF POLYMER SPECIMENS

Nguyen Thao Nguyen and Carl Nelson, Department of Mechanical and Material Engineering, University of Nebraska–Lincoln, NE 68588

The goal of this study is to examine the surface properties, particularly electrical conductivity, of polymer composites under loading conditions to understand the characteristics of the material using a new and different approach. The project also aims to characterize aging through surface electrical conductivity by comparison of the properties of non-aged composite samples and long-term aged samples where fiber strands are already disrupted. In particular, fiber composite overwrapped pressure vessels commonly used in space vehicles are of interest in this study. Composite samples are prepared with a conducting surface layer to undergo electrical conductivity tests using the four-point probe method while being mechanically loaded in a tensile testing machine. The samples are expected to experience a drop in electrical conductivity corresponding to an increase in mechanical deformation.

#### LEARNING ORGANIC REACTION MECHANISMS USING NSAIDS

Kathleen James, ShriHarsha Upplauri, and Ganesh Naik, Department of Chemistry, College of Saint Mary, Omaha, NE 68106

The goal of this project is to create an organic reaction mechanism guidebook which can be used as a handy reference/study resource for science majors at College of Saint Mary. It will focus on the preparation of pharmaceutical compounds such as Aspirin, Acetaminophen, Naproxen, Ibuprofen and the mechanism of the reactions employed in the synthesis. In addition, a brief history of the compounds and their uses and side effects will be included to draw students' interest and make them aware about the importance of reaction mechanisms in drug development. If there are multiple methods of industrial production, it will be listed in the study guide, so students can see that different reaction strategies used to prepare the compound of interest.

#### AN OVERVIEW OF THE UNL SEPPO SCIENCE OUTREACH PROGRAM

Marina Bradaric and Sam Cajka, Department of Physics & Astronomy, University of Nebraska–Lincoln, NE 68588

This presentation will provide an overview of the Science & Education Partnerships in Public Outreach (SEPPO) program – a successful science outreach effort at the University of Nebraska–Lincoln. Our presentations utilize the technical background of science majors and the communication skills of education majors. Our main audience has been scouts and after-school clubs consisting of students aged eight to fourteen. We will detail the motivations for primarily offering the presentations on campus and keeping the number of SEPPO members modest. We will describe our presentations –

Electric Charge, Telescope Optics, and the Night Sky which have been frequently offered. We plan to offer Violence in the Solar System and Galaxy Classification in the near future. We will describe how our program is currently evaluated by collecting surveys from students and chaperones. SEPPO presently receives partial funding from the NASA Nebraska Space Grant.

#### COLLEGE OF SAINT MARY ELEMENTARY SCIENCE OUTREACH PROGRAM

Kathryn Dearing and Kelly Lane, Department of Biology, College of Saint Mary, Omaha, NE 68106

The College of Saint Mary (CSM) Elementary Science Outreach Program was developed to increase elementary student interest in science by providing them with hands-on science learning experiences and promoting the consideration of STEM disciplines in future career planning. Hands-on activities and lesson plans were developed to support the science concepts outlined in the school district science curriculum. The program supports teachers of science and the district curriculum by having CSM science students lead activities and provide materials and equipment at no cost. Currently, the program serves three classrooms that include second, third, and fifth grade students. Each of the participating classrooms receives a one-hour, monthly lesson with two CSM students, using materials and equipment that are otherwise not available at their public school. The success of the outreach program is measured by feedback received from the classroom teachers and CSM student observation.

#### FEDEX CONNECTING THE WORLD

Colby Ranslem, Tyler Klingemann, and Cesar Zuluaga, Aviation Institute, University of Nebraska at Omaha, NE 68182

In the midst of aviation crisis when a mass of airlines are declaring bankruptcy and many others participate in talk of mergers, FedEx has emerged as the top global cargo carrier. This company has made the world “run on time” and has bestowed expectations on cargo transportation that would have been unthinkable just a half century ago. What once took days to deliver now can be accomplished over a single night. FedEx has created an efficient and accessible system, a casting of a web, a web that will continue to grow until everything and everyone is connected. This web and this company is what the students of the Aviation Institute from The University of Nebraska Omaha went to see in October 2011.

#### INTEGRATING RESEARCH INTO THE CURRICULUM AT A SMALL COLLEGE

Elizabeth Arnason, Alexandra Egentowich, Katie James, Alica Newsome, and Brena Mauck, Department of Biology, College of Saint Mary, Omaha, NE 68106

Science faculty at College of Saint Mary has been working to integrate research into the biology curriculum. As an institution of higher learning without extensive research resources, we are working to create a rich research experience for undergraduates focused on water quality. Faculty is introducing aspects of water quality into numerous laboratory courses as descriptive or hypothesis-driven inquiry exercises. Our goal is for students to select a capstone research project inspired by one or more of the classroom exercises. Additionally, students will further develop skills through participation in research seminars being proposed for the coming fall, each concentrating on a designated skill set we expect our students to possess upon graduation: experimental design, critical reading and thinking (journal club), proposal writing, paper writing and presentation. The expected outcome is a more structured and realistic research experience for our students that emulates a large research project without requiring expensive equipment or staffing.

#### INSERTION PROCEDURES FOR SURGICAL ROBOTS

Tom Frederick, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln, NE 68588

The development of surgical robots that are meant to be inserted into the abdominal cavity has been an ongoing area of research for many years. Robots, such as these, help to limit the trauma to the patient and have the potential to be operated remotely by a specialist. While the robot has been miniaturized to nearly fit in a shoebox, there is a need for the development of devices and techniques that can deliver the robot into the abdominal cavity with minimal risk to the robot and patient. In order to achieve the highest level of safety, it is desired that the abdominal cavity be insufflated during the insertion procedure. This research focused on the creation and testing of a system that is simple to operate and can deliver the robot into the abdomen.

#### **STEREOSCOPIC PAN-TILT CAMERA FOR SINGLE-INCISION ROBOTIC SURGERY DURING LONG-TERM SPACEFLIGHT**

Jack Mondry and Shane Farritor, Department of Mechanical and Materials Engineering,  
University of Nebraska–Lincoln, NE 68588

As humans begin planning for long duration space activities, the very real possibility of medical emergencies must be addressed. Through work performed in the Advanced Surgical Technologies Lab at the University of Nebraska-Lincoln and in collaboration with the University of Nebraska Medical Center, miniature in vivo surgical robots have been developed that can be remotely operated, eliminating the need for an onsite surgeon. One problem with this is the lack of visual feedback available to the surgeon. A new stereoscopic (3D) camera with pan and tilt capabilities has been developed that allows the surgeon a more realistic representation of the surgical environment. This includes recovered depth perception and a full view of the surgical site. The new camera unit has been successfully tested during benchtop experiments and was shown to provide improved results when compared to a fixed monoscopic (2D) camera.

#### **NASA USLI COMPETITION FOR UNL ENGINEERING STUDENTS**

Matthew Mahlin, Department of Mechanical and Materials Engineering, University of  
Nebraska–Lincoln, NE 68588

The focus of the NASA sponsored USLI project is to offer engineering students experience in high power rocketry and also development of scientific payloads in an engineering team project setting. UNL engineering students are learning how to successfully design and construct a launch vehicle capable of performing the specified mission of taking a payload to one mile in altitude and recovering both. The scientific payload this student designed launch vehicle will carry an energy scavenging experiment intended to harvest power from vibrations of the powered flight and descent. As it is truly an engineering project, there is a set of milestones the group must accomplish in order to be competitive. The team will compete against teams from 41 other universities and the event will be hosted by the Marshall Space Flight Center in Huntsville, Alabama in the spring of 2012. In addition to this, the project involves an outreach component targeted at local middle school students. Activities coordinated by project members in this outreach have taught the basic concepts of rocketry in multiple sessions culminating in launching water rockets. The goal is to engage over 100 middle school students and spark an interest in STEM fields.

#### **EMBEDDED MOTOR CONTROL OF A MINIATURE IN VIVO SURGICAL ROBOT**

Joe Bartels, Department of Mechanical and Materials Engineering, University of Nebraska–  
Lincoln, NE 68588

As NASA prepares to send astronauts on longer missions, access to in-flight medical care is becoming critical. Directed by Dr. Shane Farritor, the Advanced Surgical Technologies Lab at the University of Nebraska – Lincoln, is developing miniature in vivo robots that are capable of performing teleoperated surgery. To effectively perform surgery these robots must be as small as possible, but still have the workspace and maneuverability required by the surgical tasks. The robots developed so far

have used an external motor control box to control the motors on the robot. This method of control is unwieldy and limits the mobility of the robot because it requires over twenty cables to be connected to the robot from the motor control box. By replacing this control system with one embedded in the robot, the number of cables is reduced to only one, thus increasing the mobility and efficiency of the robot.

#### THE INTEGRATION OF IPAD TECHNOLOGY INTO STEM EDUCATION COURSEWORK

Neal Grangenett, Elliott Ostler, and Neal Topp, Department of Teacher Education; Robert Shuster, Department of Geography and Geology; Dr. Michael Matthews, Department of Mathematics; and Dr. Dana Richter-Egger, UNO Math and Science Learning Center, University of Nebraska at Omaha, NE 68182

The iPad 2.0 and similar hand-held technologies represent a powerful new learning tool for the STEM Education classroom. They are innovative, inexpensive, convenient and high-powered computing devices, with the promise of helping teachers to reach students in ways that might not be possible with more expensive and less convenient technologies, such as desktop and laptop computers. This project assembled a team of 20 educators who are becoming relatively experienced in these technologies to further investigate and plan for the integration of iPad 2.0 technology into selected STEM courses at UNO. The project was led by the Office of STEM Education at UNO and represents a close collaboration between faculty in three colleges at UNO, two colleges at UNL, the College of St. Mary and a school district president from the Walthill Public Schools, on the nearby Omaha reservation. The faculty meet together periodically in small groups and larger group settings to collaboratively plan how to use iPad 2.0 technology to help to integrate NASA-related imagery, information-related tools, and mobile application (app) resources into STEM Education coursework. This poster session will discuss promising “apps” for STEM learning explored by these educators, as well as to demonstrate new “rover” and “quadricopter” drone technologies controlled by iPads which have significant educational potential.

#### ANTHROPOLOGY

#### LIFE ON THE EDGE: AN ARCHAEOLOGICAL INVESTIGATION OF THE UNSHELTERED IN LINCOLN

Alan Andersen, Kate Kollars, Rachel Soukup, Emily Spack, and LuAnn Wandsnider,  
Department of Anthropology, University of Nebraska–Lincoln, NE 68588-0368

Homelessness is a common feature of the contemporary world. Here in Lincoln, many groups and agencies are trying to address aspects of homelessness. By looking at this issue archaeologically, we hope to discover more about homelessness and offer insights into effective strategies to deal with it. Our presentation reports on a small investigation of an area frequented by the Lincoln unsheltered.

#### FORENSIC ANALYSIS APPLIED TO THE ARCHAEOLOGICAL INVESTIGATION OF OLD BERNE MENNONITE CEMETERY

Jenny Hildebrand, Department of Anthropology, University of Nebraska–Lincoln, NE 68588-0368

Recent applications of multidisciplinary approaches combine the fields of forensic science and archaeology. Commonalities between the two create superior conditions for analyses and investigation. Techniques used by forensic investigators can be applied to historical documentation and archaeological investigations. Here, the focus is on an excavated Mennonite cemetery and the background research conducted under the rubric of a multidisciplinary approach combining the strongest aspects of the aforementioned disciplines. Focus is placed upon the spatial distribution of children’s graves and associated historical documents in the form of photographs, newspaper articles, and diary entries. The

lack of information pertaining to the understanding of the Mennonite burial practices of children and the lack of data associated with known excavated Mennonite cemeteries will be addressed. This research will contribute to the understanding of the treatment of children in mid-19<sup>th</sup> century among Mennonite societies. Two main aspects of research will be emphasized; the first will be the previous periods of exhumations from the Old Berne Cemetery to the M.R.E. Cemetery, and the graves of children based on the synthesis of archaeological methodology with the application of forensic techniques. This application of mortuary analysis of sub-adults can greatly contribute to the ever-growing field of childhood archaeology and its literature.

#### THE PREHISTORIC CROCK-POT: REPLICATION OF A PIT-HEARTH

Chris Rowe, Department of Anthropology, University of Nebraska–Lincoln, NE 68588-0368

Pit-hearths were traditionally used on the Great Plains throughout the past to process as much food as possible at a single time. Pit-hearths are distinguished from other cooking methods because of the knowledge required and time involved. Recreating a traditional pit-hearth through experimentation conducted at the Hudson-Meng Bison Bonebed in the summer of 2011 allows us to better understand this processing style & plains lifeways in general. This recreation was done using locally available materials such as chokecherry, and utilized beef instead of bison. Although the results were delicious, problems encountered along the way led to ideas of how improve upon our methods, and a discussion of these improvements will be presented.

#### THERE ARE ROCKS AND THEN THERE ARE ROCKS! AN INTRODUCTION TO NATIVE AMERICAN LITHIC SOURCES AND USES

Mark J. Awakuni-Swetland, Department of Anthropology, University of Nebraska–Lincoln, NE 68588-0368

What is the common factor shared by a person constructing a material culture class curriculum, replicating prehistoric and historic technologies, or just wanting to be able to use natural materials to survive' on a weekend campout? It is the knowledge of 'rocks'. This paper describes the early stages of locating appropriate geologic resources in the central Great Plains for all of the above activities. Geologic resources of primary interest are lithics suitable for sharp-edged tools, blades, and points; rounded cobbles for hammer stones and mauls; softer stones for carving; clays for pottery; and earth paints. Accessible sources on the landscape are being identified and representative samples collected. How each resource is processed into a unique end product is being researched and tested. Information comes from historic documents, community informants, internet resources, university faculty expertise, and members of the Lincoln Gem and Mineral Club.

#### HISTORY OF EDUCATION AND REMOVAL OF NATIVE AMERICAN CHILDREN

Barbara Salvatore, Institute for Ethnic Studies/Native American Studies, University of Nebraska–Lincoln, NE 68588-0685

There are at least as many stories as there are people who passed through the doors of America's Mission and Boarding Schools, but I focus on one Mission School in particular, one tribe, and one family, who pinned its highest hopes on the education that this mission school promised to deliver to their children. I also examine contemporary stories of foster care and adoption; describe a government system of "Social Services" that basically steals native children away, a practice rooted back centuries. The process of removing Native Children from their homes insidiously goes on today, patterns repeated and repeated again. My own childhood was riddled with questions of identity, my grandmother linking me to this tradition. My questions motivate much of my research and I wonder how many people carry the same questions. How many families? How many tribes torn apart, separated, piece by piece, child by child? It is this foundation of questions, which steers the opinion of my essay.

## HORSES, WARFARE AND SOCIAL REORGANIZATION: MACRO-LEVEL TRANSFORMATIONS OF PAWNEE SOCIETY DURING THE PRE, PERI AND POST CONTACT PERIODS

Amanda F. Callahan-Mims, Department of Anthropology, University of Nebraska–Lincoln, NE 68588-0368

The exertion of control over two way trade exchanges, or minimally the perception of power over trade, can be viewed as an attempt to manipulate the act of exchange to pursue actions beyond economic motivations. Historically, in archaeological and ethno-historical studies Native Americans are often portrayed as passive participants in trade, whereas the Euro-American motivation is viewed as profit based. For the Pawnee the act of trade was a social exchange - an opportunity to create, confirm and strengthen relationships. The unintentional exchange of nonmaterial substances such as germs and disease resulted in significant social restructuring. Epidemics became one of the main causes for disrupting Native American societies in the Plains, especially within horticultural societies whose sedentary lifestyle made them especially vulnerable. Increasing Euro-American contact caused changes within Pawnee society that further altered social, cultural and religious traditions, in addition to material culture. Constant contact with Europeans since about 1777 contributed to vast changes in the traditional lifestyles of the Pawnee. This contact with Euro-Americans resulted in changes in the material culture of the Pawnee that is visible in the archaeological record by looking at artifacts, earthen fortifications and horse corrals. Later, changes in interactions with Euro-Americans, such as treaties and annuity payments caused increased reliance on Euro-Americans. This reliance coupled with vulnerability perpetuated by population loss further contributed to an already unstable society.

## DISPLAYS OF PERSONAL ADORNMENT AND BODY ART AS COSTLY SIGNALING: A CASE STUDY

Michelle Night Pipe, Department of Anthropology, University of Nebraska–Lincoln, NE 68588-0368

The Lakota (Sioux) tribes of the nineteenth century devoted an enormous amount of time, energy, and resources to the production of lavish clothing, headdresses, jewelry, and accessories. These items seemingly lack any practical survival or reproductive benefits, making them difficult to account for in evolutionary terms. Costly signaling theory, however, predicts that the costs of the production of body art and personal adornment are offset by the accumulation of prestige. This prestige ultimately translates into differential reproduction for the signaler. While both Lakota males and females signaled prestige through body art and personal adornment, for males this signaling was more intensive and resulted in a more significant payoff. This paper will explore the myriad of ways that prestige was signaled by males both within and between Lakota societies, as well as the benefits that were accrued as a result of their signaling behavior.

## EATING AND OWNING “YOUR” FOOD: THE INTERCONNECTIONS OF DIABETES MELLITUS, THE INTELLECTUAL PROPERTY RIGHTS (IPRs) REGIME, AND NATIVE AMERICAN FOLK CROP VARIETIES

Mayo Buenafe, Department of Anthropology, University of Nebraska–Lincoln, NE 68588-0368

Folk crop or landraces serve specific ecological and social needs of the public as a source of sustenance and subsistence to combat major community health issues such as the diabetes mellitus among Native Americans. Yet the intellectual property claims over folk crop seeds, folk crop germplasm, etc. by industrial agriculture companies, biotechnology firms, and university research institutions undermines these social and ecological needs with tendencies to monopolize plant resources. This research seeks to identify the ethical considerations of gene prospecting, transgenics, and seed patents on folk crop or landrace ownership amidst implementing strategies of folk crop diets that prevent and control Type II diabetes among Native American populations. Through the Political Ecology of

Health Model, this study critically describes the diabetes mellitus epidemic among Native Americans and reclamation efforts and strategies of Native Americans' right to self-determine the use, allocation/ownership, and cultural representation of their folk crop varieties; despite biotechnology industries' gene prospecting and transgenics through patenting landrace seeds under the Intellectual Property Regime or IPRs. The results of the research identifies the contentious economic, political, ecological and social (nutritional/health) implications of "eating" and "owning" folk crop varieties or landraces by interested parties (e.g. biotechnology industries and indigenous populations); and advocates for education, consent, and fair access of Native Americans to folk crop food sources in order combat diabetes. The ownership, control, and protection of indigenous farmers' landraces are crucial to the sustainability of community health programs targeting the prevention and control of Type II diabetes among Native American populations.

#### CULTIVATING SOCIAL-ECOLOGICAL COMMUNITY: A QUALITATIVE CASE STUDY EXPLORING SOCIAL-ECOLOGICAL RESILIENCE IN COMMUNITY GARDENS IN VIENNA, AUSTRIA

Joanna Chan, School of Natural Resources, University of Nebraska–Lincoln, NE 68588-0989

Urban agriculture has a long history of providing social, economic, and ecological services to cities worldwide, especially in poorer communities and during times of crises. For over a century, gardens have played a pivotal role in both the social and ecological communities of Vienna. The purpose of this qualitative case study is to understand social-ecological resilience in the context of culturally and ecologically diverse community gardens in Vienna, Austria. Social-ecological resilience is defined as the capacity of complex social-ecological systems to absorb natural and social disturbance and adapt to change. In this study, we focus on three commonly identified qualities of social-ecological resilience: diversity, adaptive capacity, and learning. In-depth semi-structured interviews were conducted with three community garden coordinators and seven gardeners, supplemented by participant observation at the three community garden sites.

#### IMMIGRANT STUDENT EDUCATION: ANALYZING THE POTENTIAL

Kristine Sudbeck, Department of Anthropology, University of Nebraska–Lincoln, NE 68588-0368

Over the past 40 years, the United States has undergone a dramatic increase in its foreign born population. Suárez-Orozco & Suárez-Orozco (2009) note that the United States' foreign-born population is soon to surpass the 40 million mark, and nearly a quarter of all children in this country today come from immigrant-origin households. Many of these students come with limited English proficiency and little familiarity with the American education system. Given this context, what are the most critical factors influencing an immigrant student's academic performance? These factors can be categorized into three main realms: home factors, school factors and individual factors. This review of literature will provide a basis of understanding for these underlying factors, whether direct or indirect, and provide alternative strategies to see these immigrant students' academic performance improve.

#### TO SHAKE THE TRUTHFULNESS OF SCIENCE: A HISTORY OF ETHICS IN ANTHROPOLOGY

Heidi J. Paneitz and Steven J. Sarich, Department of Anthropology, University of Nebraska–Lincoln, NE 68588-0368

Throughout the history of anthropological research, there have been many incidences of questionable ethical practices and procedures that have altered the trajectory of contemporary fieldwork. Ethical debates have become increasingly more heated as a result of several paradigmatic shifts and challenges to the discipline such as postmodernism and critical theory. We will provide an in-depth chronological outline of major ethical debates in the field of anthropology and consider both short- and long-term implications for the study of people and culture. Major developments in the evolution of

professional ethical guidelines within the discipline will be charted in order to achieve a more comprehensive understanding of factors critical for the responsible conduct of research. In conclusion, we will discuss the current state of ethics in anthropology and speculate as to what trends we may expect for the future.

### **HOW THE PAST SHAPES THE PRESENT: EXAMINING DECISION MAKING USING AN EVOLUTIONARY PERSPECTIVE—ASSOCIATING FLUCTUATING ASYMMETRY AND CHOICE-BLINDNESS**

Jackson S. Wagoner, Department of Anthropology, University of Nebraska-Lincoln, NE 68588-0368, Megan E. Hansen, School of Biological Sciences, University of Nebraska-Lincoln, NE 68588-0118, Rachel A. Coburn, Department of Biochemistry, University of Nebraska-Lincoln, NE 68588-0664, and Katelynn Gonzalez, Department of Entomology, University of Nebraska-Lincoln, NE 68583-0816.

Symmetry in the hands and face is thought to be a marker of genetic quality. People with symmetrical faces are consistently rated as being more attractive than those who don't. In the literature, deviations from perfect symmetry are referred to as fluctuating asymmetry (FA), and are additive across an individual's lifespan. FA is indicative of an individual's ability to buffer stress; this is adaptive, and thus (the thinking goes) more attractive to potential mates. In 2005, Petter Johansson and colleagues demonstrated, through sleight-of-hand, that people are not accurate at detecting mismatches between decisions they had made and ones they had not. This phenomenon is referred to as choice-blindness. Our objective was to examine correlations between asymmetry in the photos—in addition to the asymmetry in the participants—and the detection rate of choice blindness. We recruited a convenience sample of heterosexual males and females (n=20: 10m, 10f) from a major public university. We showed participants fifteen trials of two faces of the opposite gender and asked them to select the most attractive face; they were given five seconds to decide. After they chose, we showed them the image they selected and asked them to justify their choice. At random intervals, we used sleight-of-hand to show the face they did not select and asked them why they found it more attractive. We used emotion-neutral (not smiling/frowning) pictures from the University of Sterling's psychological research collection, and controlled for asymmetry by using ImageJ. Using an 18 megapixel camera, we photographed the participants' hands and tabulated the 2D:4D ratio using ImageJ. All statistical analysis was conducted in IBM SPSS (v. 20).

### **APPLIED SCIENCE AND TECHNOLOGY**

#### **HIGH-RESOLUTION MAPPING OF PLAYA WETLANDS WITH LiDAR**

Yao Li, Nan Zhao and Zhenghong Tang, Department of Community and Regional Planning, College of Architecture, University of Nebraska-Lincoln, NE 68588; and Dr. Ruopu Li, School of Natural Resources, University of Nebraska-Lincoln, Lincoln, NE 68583

As wetland management frequently requires analysis of topographic and hydrological features, it is significantly crucial to construct accurate wetland maps for wetland protection and restoration. In this research, LiDAR-derived 3-D wetland maps offer robust capability of improving quality and accuracy of topographic features and hydrologic parameters. Additionally, a standardized method to produce 3-D wetland maps and capture the critical spatial parameters was established. ArcInfo and Python scripting were developed to extract LiDAR-derived, 3-D wetlands in all of historical hydric soil footprints. Moreover, ArcHydro Tool and ArcGIS ModelBuilder were used to develop a protocol for delineating critical topographic, hydrologic parameters - watershed boundary, drainage lines, drainage points, and



depressions. This study delineated 1,788 watersheds and identified 52,328 depressions in Playa wetlands. Also, one geodatabase with five deliverables was developed in this project: 3-D wetland map, wetland boundary, LiDAR-derived watershed boundaries, drainages related to wetland connectivity and captured parameters from topo maps.

#### DEVELOPMENT OF LiDAR APPLICATION IN WETLAND RESOURCES MANAGEMENT

Yao Li, Department of Community and Regional Planning, College of Architecture,  
University of Nebraska–Lincoln, NE 68588

LiDAR has become a leading technology in high-resolution terrain mapping which improves the efficiency, cost effectiveness compared with traditional methods such as topographic mapping or field survey. Wetland resources management frequently requires analysis of hydrological features such as terrain, slope and drainage networks. Different studies examined that airborne LiDAR significantly enhance the quality and accuracy of hydrological features. Around coastal area, LiDAR was explored to inform the land use and ecosystems caused by sea level changes, which significantly improve the efficiency for tidal hydro-dynamic wetland management. Within landlocked area, DEM derived from LiDAR brings advantage in mapping accuracy, detailed hydrologic object including surface area, depth and storage volume, compared with traditional DEM. However, densely vegetated and wet environments are still questionable blurred areas for applying LiDAR technology. And some scholars have explored the model to improve it for future application and combination with high aerial photos.

#### SIMULATION OF THE AREA-COVERAGE PROBLEM IN WIRELESS SENSOR NETWORKS

Ali Rezaeian and Professor Azad Azadmanesh, Department of Computer Science, The  
Peter Kiewit Institute, University of Nebraska at Omaha, NE 68182-0500

The *area-coverage problem* refers to the coordination and placement of sensors to efficiently cover a sensor field so that the coverage needs of the application are guaranteed. Some major challenges of the area-coverage problem include the development of sensor placement algorithms, the resiliency of a field coverage in case of sensor failures, or the ratio between the field grid points and the number of sensor nodes for efficient sensor coverage. With many factors and options involved in a field coverage, a simulation software can help designers avoid pitfalls and better understand the challenges before deploying sensors in the physical world. This in-progress research provides some of the challenges in the area-coverage problem and a brief presentation of the on-going development of the simulation software.

#### DEVELOPING METHODS TO STUDY MAGNETICALLY CONTROLLED MOLECULAR MOTORS

Seth Dallmann and David Peitz, Department of Physical Science and Mathematics,  
Wayne State College, Wayne, NE 68787

The synthesis and characterization of compounds that could be used as molecular motors (magnetically controlled in this research) continues to be an area of interest in the materials field. Construction of a compact device that generates a low to moderate magnetic field that could be used in conjunction with conventional instrumentation would be advantageous in the study of these compounds. The design of sample holders that allow variable strength magnetic fields (up to 1 Tesla) for IR, UV and polarimetry will be shown. These sample holders are used for the comparison of the spectroscopic properties of planar chiral arene  $\text{Cr}(\text{CO})_3$  compounds in, and out of, a magnetic field. Analysis of a variety of achiral and chiral compounds will be used to illustrate that if a molecule's optical properties are affected, it is a result of the unidirectional rotation (a molecular motor) of the  $\text{Cr}(\text{CO})_3$  moiety.

## PROGRESS IN THE MODERNIZATION OF THIN LAYER CHROMATOGRAPHY (TLC), USING ANODIZED ALUMINUM TO PRODUCE ALUMINA PLATES WITHOUT BINDERS

Alexis Sieh, Mary Ettel, and David Peitz, Department of Physical Science and Mathematics, Wayne State College, Wayne, NE 68787

TLC is a common, practical procedure in any organic chemistry lab; it can run several samples at once and with minimal expense. Although versatile, integration of TLC into qualitative and instrumental methods of analysis has been slow. This is due in part to the difficulty in creating ultra thin plates and the presence of binders used in the manufacture of the plates. These binders often interfere with the subsequent instrumental protocols. The creation of ultra thin plates that do not use binders will be a significant step forward in integrating TLC with instrumentation. Binderless alumina TLC plates can be made using anodization, an electrolytic process used to create a uniform, porous oxide matrix on a metallic aluminum surface. The thickness of the aluminum oxide matrix as well as the dimensions of the pores can be controlled to develop process specific TLC techniques. Preliminary results of a study investigating the viability of thin, anodized surfaces as stationary phases in thin layer chromatography procedures will be presented.

## DESIGN OF A LIGHTWEIGHT STEREOSCOPIC VIEWER FOR MINIMALLY INVASIVE TELE-OPERATED ROBOTIC SURGERIES

Jacob G. Greenburg, Department of Mechanical and Materials Engineering, University of Nebraska–Lincoln, NE 68588-0526

Tele-operated surgeries are crucial to the success of a long term space flight. Should an astronaut become ill, a system could be used to perform delicate operations without the surgeon being physically present. While this is a major breakthrough in surgical technology, there are still challenges to overcome. One of these challenges is a vision system. In order to perform minimally invasive surgery, a camera must be inserted into the patient for proper visualization. However, traditional systems typically provide a two-dimensional image. This leads to depth perception problems that make the operation more difficult and could lead to unnecessary errors. The proposed solution is a system with a stereoscopic imager with a coupled viewing system. A successful viewing system needs to be compact and portable as well as adaptable to changing technologies. This study presents work towards the development of a 3D stereoscopic imaging system for minimally invasive surgery.

## EVALUATION OF INDIGENOUS OILS FOR THEIR POTENTIAL USES AS SUNSCREENS

Amber Kutnink, Katelyn Thiele, and Darius Agoumba, Department of Physical Science and Mathematics (PSCM), Wayne State College, Wayne, NE 68787

In light of skin cancer being the most prevalent form of cancer in the United States, it is crucial that more studies be done to discover new techniques to cure or to prevent this epidemic. To lessen the degree of skin damage, consumers turn to sunscreen. Sunscreens are categorized by their sun protection factor (SPF). Unfortunately, not all lotions are as efficient as their labeled values. Thus, it is imperative to find less expensive, yet more efficient products that can be used. Several indigenous oils were taken into account to assess their potential applications as sunscreens. Results of our investigation will be presented.

## EVALUATION OF HEAT CONTENT IN DIFFERENT OILS AND BIODIESEL FUELS VIA CALORIMETRY

Evan Canning, Jake Janak and Darius Agoumba, Department of Physical Science and Mathematics (PSCM), Wayne State College, Wayne, NE 68787

Bomb Calorimetry is the method of choice in the evaluation of heat contents of a variety of natural products. With the development of biodiesel to replace petroleum fuels and diesels, it becomes

interesting to evaluate the heat contents of potential vegetable oils to be used in making biodiesel. Results will help in deciding whether a given biodiesel newly produced is worth to be tested for further fuel quality tests. Consequently, palm, palm kernel, grape seed oils and shea butter were used to make biodiesel's fuels. Products were tested for their heat contents after the bomb calorimeter was calibrated and its heat capacity found. In addition, given the fact that one of biodiesel current biggest drawbacks is that it gels under cold weather, cloud points of the different produced biodiesels were evaluated and compared to the one of petroleum diesel. Conclusions of our investigations will be presented as well as our suggestions regarding other applications of the above mentioned oils.

#### MULBERRIES AS A HISTOLOGICAL STAIN: RESULTS FROM ANIMAL CELLS AND TISSUES

Carissa Wollman and Glenn E. Kietzmann, Department of Life Science, Wayne State College, Wayne, NE 68787

Historically, natural dyes have been used routinely in the staining of fibers and textiles, but their use as histological stains is not as well documented. In histology synthetic, toxic, and costly dyes have been used more routinely, due primarily to the unavailability of good natural dyes. With this report we will describe the suitability of a black mulberry dye (*Morus nigra*) when used to stain animal organ sections and protozoan smears. The black mulberry stain was used on liver from black-tailed prairie dogs (*Cynomys ludovicianus*) and cells of *Trichomonas gallinae*. It appears that nuclear proteins and cytoplasmic granules in liver sections stained as did hydrogenosomes, axostyle, and costae of trichomonads. Mulberry stain prepared in a 10% aluminum potassium sulfate solution appeared to have better staining characteristics than did mulberry stain prepared in a 10% zinc sulfate solution.

#### UNDERGRADUATE RESEARCH IN MATHEMATICS

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This is a report on an effort that is being made in the UNO mathematics department to develop and challenge the pool of strong mathematics students who come to UNO, will graduate and are then likely to pursue a PhD in mathematics or a related field. Since the mini-grant provided funding for three students to take a course in Hopf Algebras and pursue their research projects, this report will discuss these activities and their outcomes.

### **BIOLOGICAL AND MEDICAL SCIENCES** **SESSION A**

#### IN VITRO ELONGATION OF PORCINE EMBRYOS USING ALGINATE HYDROGELS AS A THREE-DIMENSIONAL EXTRACELLULAR MATRIX

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In the pig, the pre-implantation period of pregnancy is highly influential on sow productivity and therefore the profitability of swine production. Between Days 11 and 12 of gestation, the embryo undergoes a significant morphological change, known as elongation, which is critical for maternal recognition of pregnancy and subsequent embryo spacing in the uterus, placental development, and fetal growth. Approximately 20 percent of embryonic loss is associated with this elongation process. An effective in vitro culture system could help us develop a clear understanding of the pre-implantation period of porcine embryos, in particular elongation, which in turn can allow us to identify physiological components that could be manipulated to improve pregnancy outcomes. To date, attempts to elongate porcine embryos in vitro have been unsuccessful. We hypothesize that failure of pig embryos to

elongate in vitro is due to inadequate culture systems lacking three-dimensional (3-D) structure to support appropriate embryo biomechanics. Therefore in the present study, we have established a culture system using low-percentage alginate hydrogels as a 3-D matrix that promotes in vitro porcine embryo elongation with a corresponding increase in steroidogenic transcripts and estradiol production, consistent with later-stage in vivo-produced embryos. Cell survival, assessed by blastocyst fragmentation and confirmed by live/dead staining in representative embryos, was greater ( $P=0.01$ ) for encapsulated embryos ( $60.1\pm4.8\%$ ) compared with controls ( $33.3\pm4.8\%$ ). Of encapsulated embryos, 27% had some morphological change (minor flattening and tubal formation) and 14% had significant morphological changes (considerable flattening and tubal formation elongating through the gel), consistent with in vivo embryo elongation. In contrast, the control embryos had no morphological changes observed and remained spherical during culture. The expression levels of the steroidogenic transcripts STAR, CYP11 and CYP19 were significantly ( $P<0.05$ ) greater in encapsulated embryos compared with control embryos. Furthermore, a significant ( $P<0.01$ ) time-dependent increase in estradiol levels in the culture media of encapsulated embryos was identified compared with controls and culture media alone. These results illustrate that cultured pig embryos encapsulated in alginate hydrogels undergo limited morphological changes with increased expression of steroidogenic transcripts and estrogen production.

#### EFFECT OF TIMP-2 ON NEURAL CREST PATHFINDING

Anne Elizabeth James, Alicia Muhleisen, and Mark V. Reedy, Department of Biology; and Philip R. Brauer, Department of Biomedical Sciences, Creighton University, Omaha, NE 68178

Previous studies suggest tissue inhibitor of metalloproteinase-2 (TIMP-2) plays a role in neural crest (NC) pathway choice. TIMP-2 expression by cranial NC correlates positively with taking the dorsolateral pathway. However in the trunk where TIMP-2 is not expressed in NC cells, NC cells initially take the ventromedial pathway. Here, we tested whether miss-expression of TIMP-2 in trunk NC cells redirects NC cell migration into the dorsolateral pathway. A bicistronic vector driving both TIMP-2 and enhanced green fluorescent protein (EGFP) expression or one lacking the TIMP-2 sequence was introduced by *in ovo* electroporation into NC precursors at the future wing bud axial level. Embryos were then reincubated for 24 hours and those exhibiting EGFP expression were fixed, immunostained as whole mounts for EGFP and NC cells (HNK-1 antibody), embedded, and sectioned. Pathway choice of trunk NC cells was scored as either taking the ventromedial, dorsolateral, or both. Our results show that miss-expressing TIMP-2 in early trunk NC cells significantly increases dorsolateral migration.

#### MEASURING THE RATE OF NICOTINE UPTAKE IN DEVELOPING EMBRYOS

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The developing chicken embryo is a good model system for studying how teratogens like nicotine disrupt normal development. We have shown previously that exposure to a single low dose of nicotine at neurulation significantly disrupts normal development four days later. However, attempts to understand the mechanism behind these effects have been hampered by not knowing how quickly the embryos actually take up the nicotine from the yolk. Here we report on our preliminary efforts to develop a method for measuring the rate of nicotine uptake using HPLC and GCMC.

#### VALIDATION OF AN ENZYME IMMUNOASSAY TO MEASURE FECAL CORTICOSTERONE IN NESTLING RED-WINGED BLACKBIRDS (*AGELAIUS PHOENICEUS*)

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Measurement of fecal corticosterone (CORT), the avian stress hormone, is an important tool used to evaluate perceived health of developing offspring. CORT is primarily involved in regulating homeostasis in organisms and is associated with survival. To accurately measure fecal CORT,

individualized assay protocols must be developed for each species. In this study, we identify an extraction procedure and an enzyme immunoassay useful for measuring fecal CORT in red-winged blackbird nestlings (*Agelaius phoeniceus*). This method will be used to measure fecal CORT in future studies to evaluate the influence of social and environmental cues on offspring growth and survival. This work was made possible by Grant Number P20GM103427 from the National Institute for General Medical Science (NIGMS), a component of the National Institutes of Health (NIH).

#### INVESTIGATION OF THE PUTATIVE DNA MOTIF ASSOCIATED WITH *T. GONDII* BRADYZOITE INDUCTION

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*T.gondii* is an apicomplexan parasite which infects humans and a wide variety of other mammals. In the United States, it is a leading cause of congenital defects. We are investigating the formation of the bradyzoite, or chronic, stage of *T.gondii*. This stage is completely resistant to chemotherapy or other form of clearance, and has recently been associated with host behavioral changes. We are particularly interested in studying a novel CT-rich DNA motif found upstream of recently identified bradyzoite-specific genes, which may serve as a transcription factor binding site responsive to bradyzoite transition initiation. Initial studies suggest the binding of yet unknown transcription factors present only in the bradyzoite stage to this conserved motif. Our current study involves measuring transgene expression under the control of motif-containing and known stage-specific promoters.

#### SKELETOCHRONOLOGY RESULTS OF LITHOBATES SPHENOCEPHALUS FROM SOUTHERN FLORIDA

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Skeletochronology has been used successfully by others to estimate individual age and population structure of a variety of amphibians from toe or femur sections based on lines of arrested growth (LAG). The underlying assumption presumes a period each winter during which individuals were not active, resulting in reduced bone growth producing LAGs; typically one line for each year of life. We sectioned both toes and femurs of 21 adult *L. spheoncephalus* from southern Florida to see if life in a subtropical environment resulted in the absence of LAGs. We found differences in the number of LAGs present in toe sections versus femur sections. Our results suggest that: 1) Femurs are a more reliable indication of LAGs than toes; often there were no lines in the toe and 2 or more in the femur sections. 2) On occasion a toe yielded a higher count than the femur. 3) In the past others often assumed that larger individuals were older, but in our study, SVL was not a good predictor of age.

#### ALIEN GENES: IS HORIZONTAL TRANSFER OCCURRING IN THE SIMULIIDAE?

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The Simulium Genomics Project has produced a transcriptome of the only colonized species of black fly, *Simulium vittatum*. Preliminary annotations identified several genes that are closely related to mammalian genes rather than other insects. Some of these genes were most closely related to large mammal genes such as *Bos taurus* (domestic cattle). *S. vittatum* is a blood-sucking insect which usually feeds from large mammals such as cattle and deer. The colony, however, is not blood-fed but is maintained in its autogenous form. We are attempting to map the cattle-like genes to the giant polytene chromosome to test if these genes are in fact part of the black fly genome. We are hypothesizing that the genes transfer could be a result of a horizontal transfer via the blood meal.

## CHARACTERIZATION OF RED PIGMENTED BACTERIA FROM POTASH LAKES IN THE NEBRASKA SANDHILLS

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Extremophiles are microorganisms that thrive in physically or geochemically extreme conditions and exhibit unusual adaptations to the environment that allow them to survive. Extremophiles have contributed greatly to science with the discovery of enzymes like Taq polymerase and are important in understanding evolution and the diversity of life. The Sandhills in western Nebraska are home to a number of potash lakes. These lakes are alkaline-saline with pH's ranging from 8-12 and high concentrations of potassium and sodium salts. Although these conditions are extreme, the potash lakes are thriving with microbial life that remains largely unexplored. In this study, water samples were taken from Kokjohn Pond and Border Lake, both of which are highly alkaline-saline. Nineteen bacteria with red pigment were isolated and grown on media with varying salt and pH. Sixty three percent of the isolates grew up to 15% sodium chloride and 15% potassium chloride. All of the isolates grow better with carbonate to make the medium alkaline, but nutrient concentration did not seem to affect growth. The bacteria grew equally well at one-tenth strength nutrient concentration as full strength. DNA has been extracted from each isolate, and 16S rDNA sequencing will be completed. Data will be used to generate a phylogenetic tree to better characterize the biodiversity in this extreme environment. This work was made possible by Grant Number P20GM103427 from the National Institute for General Medical Science (NIGMS), a component of the National Institutes of Health (NIH).

## DIFFERENTIAL GENE REGULATION OF THE *icaADBC* OPERON IN *STAPHYLOCOCCUS EPIDERMIDIS*

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*Staphylococcus epidermidis* normally resides upon human skin, but under certain conditions *S. epidermidis* can become pathogenic. *S. epidermidis* is the number one cause of infections on indwelling medical devices like catheters. The biofilms formed by *S. epidermidis* when it comes in contact with plastic devices are resistant to antibiotic treatment. Previous research has implicated the *ica* operon in the development of these biofilms. Preliminary data also suggests the *ica* operon is differentially regulated during biofilm development. Northern blot analysis will be used to determine the actual variation in gene expression. The first step in this process was to create DNA probes to allow analysis of the northern. Multiple protocols for extracting DNA from *S. epidermidis* were attempted with unsatisfactory results. Through the merging of an existing protocol for *S. epidermidis* DNA extraction and another protocol for *S. epidermidis* RNA extraction, we were able to make a new protocol for DNA extraction. With the use of this protocol, more DNA was extracted, allowing for creation of probes for the northern blot. Northern analysis is currently being completed and will indicate the changes in gene expression believed to occur within the *ica* operon of *S. epidermidis*.

## ELUCIDATING THE MECHANISM FOR ABNORMAL GROWTH IN *TOXOPLASMA GONDII* IN VARIOUS U-2 OS CLONES COMPARED TO WILD TYPE

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*Toxoplasma gondii* is an obligate intracellular parasite and is the leading cause of congenital abnormalities in the United States. It is also estimated that 30% of the world's population is infected with the parasite. *T. gondii* is also a close relative to *Plasmodium falciparum*, the causative agent of malaria. Therefore, it is extremely important to know how the parasite lives within its host and what it needs from its host in order for the parasite to live. The Davis lab has created stable U-2 OS clones that over-express individual human genes, and the parasite exhibited abnormal growth in several of the

clones. Those clones that exhibited abnormal parasite growth were selected for further research. Various assays were conducted to confirm the growth phenotypes of the parasite in the clones. Then research will be conducted into potential pathways and/or gene products that the parasite uses to grow abnormally fast or slow. By using chemical and/or genetic manipulation to elucidate the mechanisms of abnormal growth it is hoped that new information will be provided about new targets for drug development.

## BIOLOGICAL AND MEDICAL SCIENCES SESSION B

### A MAMMALIAN RIBOSWITCH IN THE SPERMINE BIOSYNTHETIC PATHWAY

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Riboswitches are found in the 5' untranslated region of mRNAs that bind cellular metabolites and induce a conformational change in the mRNA, subsequently modifying the expression of the coding region nearby. This coding region is involved in the synthesis of the same metabolite it binds, and this system provides an efficient feedback mechanism of genetic control. Various riboswitches have been described as effective controls of genetic expression in bacterial cells, but we propose here a potential mammalian riboswitch. We are investigating the structure and function of a potential mammalian riboswitch conserved over a wide variety of species and thought to control polyamine biosynthesis. Polyamines are essential for cellular proliferation and differentiation, and therefore they play a key role in cancer and tumor development. The goal of this project is to solve the crystal structure of this putative riboswitch RNA bound to the polyamine spermine. Preliminary results have aided in determining the optimal chemical conditions necessary for crystal growth. Results will render a better understanding of the binding properties of the metabolite to the RNA and may aid in development of synthetic ligands/metabolites for use as cancer therapies.

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### EFFECT OF MICRORNA-183 FAMILY ON EXPRESSION OF GENES THAT REINFORCE NEUROSENSORY CELL FATE IN THE INNER EAR

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MicroRNAs (miRs) target and inhibit complementary messenger RNAs (mRNAs). The miR-183 family (miR-183, -182, and -96) is already known to aid in the development and upkeep of hair cells in the inner ear. Hair cells convert mechanosensory sound waves to nerve impulses. They develop in conjunction with supporting cells, where the precise regulation of gene expression reinforces differentiation as either a hair cell or supporting cell. miRs inhibit gene expression through interaction of their 7 base pair "seed sequence" with the 3' untranslated regions (3' UTRs) of complimentary mRNAs. Because the sequences of the miRs are known, the interactions of miRs with target genes are easily predicted. As such, there are databases of proposed interactions that require experimental validation. The 3' UTRs of predicted miR-183 target genes Sox2, Notch1, Hes1, and Jag1 were inserted into a luciferase reporter vector and transfected into cultured HEK293 cells with control RNA or miR-183 family members. After 24 hours, cell lysates were collected and analyzed to quantify luciferase activity. The reporter vector contains the 3' UTR downstream of a Photinus luciferase (Pluc) gene. The vector also

contains the gene for Renilla luciferase (Rluc). miR binding to the 3'UTR is expected to decrease Pluc expression relative to Rluc expression in a dual luciferase assay. Analysis of the data showed downregulation of the Sox2 reporter gene by miR-182 but not miR-183 or -96, consistent with a predicted miR-182 binding site. Similarly, Hes1 reporter gene was downregulated with miR-182 and -96 but not miR-183, consistent with a predicted miR-182/96 binding site. The Notch1 reporter gene showed downregulation with each individual miR-183 family member and greater downregulation with all three miRs combined, consistent with each miR having a predicted binding site. Jag1 reporter gene showed no downregulation with any miR-183 family member despite having a weak predicted miR-183 binding site. These results support the conclusion that miR-183 family members downregulate genes that are associated with supporting cell development, thus reinforcing hair cell fate.

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## STRUCTURAL CHARACTERIZATION AND ANALYSIS OF PRE-QUEUOSINE RIBOSWITCH

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Located in the 5' untranslated region of bacterial mRNAs, each riboswitch is composed of an aptamer domain and an expression platform. When a specific ligand binds to the aptamer, a conformational change is induced downstream in the expression platform, thus inhibiting transcription and/or translation of the mRNA and ultimately production of the ligand itself. Therefore, riboswitches provide an effective negative feedback mechanism that reduces or shuts down the production of a particular metabolite in response to its abundance in the cell. The pre-queuosine riboswitch regulates the cellular production of pre-queuosine, a precursor of queuosine, which ultimately is incorporated into the anticodon of tRNA to form queuosine-tRNA, allowing wobble base-pairing to occur. Since wobble base-pairing is the cell's natural mechanism to recognize multiple codons using a single anticodon, queuosine and pre-queuosine production are crucial to bacterial translation. Our project aims to elucidate the structure of the pre-queuosine riboswitch bound to its metabolite using X-ray crystallography, with the long term goal of developing antibiotics that mimic pre-queuosine to inhibit this essential pathway. We have subcloned the DNA sequence of interest, transformed the target plasmid into bacteria, optimized the large-scale production of highly purified and concentrated pre-queuosine riboswitch RNA, and started testing different conditions to crystallize the riboswitch-ligand complex. Preliminary results have identified optimal chemical conditions for RNA precipitation, which can lead to crystal growth. Once a crystal is successfully grown, we can use X-ray crystallography to deduce the atomic-level structural details of the riboswitch-ligand interaction.

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## STRUCTURAL TRANSITIONS INDUCED BY MUTATIONS IN THE 5'NTR OF CVB3 GENOMIC RNA

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Coxsackievirus B3 (CVB3) is a positive-sense RNA virus from the Picornaviridae family that causes myocarditis and pancreatitis. The native structure of the 5' non-translated region (5'NTR) of the CVB3 genome is necessary to promote replication and is also required for virulence. The structure of the



wild type 5'NTR has been determined previously in our laboratory by chemical probing and comparative sequence analysis. The current investigation identifies and characterizes structural transitions in the 5'NTR induced by mutations in an RNA domain known to affect virulence. RNA structure is examined and analyzed by chemical probing of the full length and fully folded 5'NTR RNA. Results have yielded evidence of significant structural transitions in a single, as well as a double mutant CVB3 genome when compared to the wild type. These results have led to a collaborative effort with laboratories from UNMC to determine not only the structural differences between wild type and mutant CVB3 strains but, also determine if there is any variation in viral efficacy between the strains. Preliminary results indicate that the double mutant genome does exhibit attenuated virulence when compared with the wild type. Full investigation of these induced structural transitions and their effect on virulence will identify the mechanisms involved in CVB3 virulence and may yield insight into host-virus interactions. This information may then be used to aid in the development of novel therapeutics against CVB3.

## USING LACTOBACILLUS ACIDOPHILUS AS A PROTECTIVE MEASURE AGAINST HIV INFECTION

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This experiment uses one bacteria species native to the intestinal and vaginal tract, *Lactobacillus acidophilus*, as a protective measure against HIV interaction with the cell membrane of these tracts. By transforming the bacteria with a gene synthesized based on the newly found monoclonal antibody pg16 gene to be displayed on the outer membrane of the bacteria the resulting colony line the intestinal and vaginal tract and prevent HIV from interacting with the cell line.

## GENOMIC ANALYSIS OF 11 ANTIGENIC MUTANTS OF THE CHLOROVIRUS PBCV-1

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*Paramecium bursaria* Chloroella virus (PBCV-1) is a member of the Phycodnaviridae (genus *Chlorovirus*), a group of large, double-stranded DNA viruses (330,611 bp) that encodes many proteins not commonly found in viruses. Unlike other viruses that use the host machinery associated with the ER and Golgi for protein glycosylation of capsid proteins, PBCV-1 and its relatives encode most, if not all, of the machinery to glycosylate its proteins. Furthermore, the process appears to occur in the cytoplasm. Five groups of PBCV-1 antigenic mutants have been isolated; the differences in the antigenic phenotypes are correlated with altered glycan structure of the major capsid protein. The purpose of this project was to uncover the genetic basis of the altered antigenicity in PBCV-1 mutants. Eleven antigenic mutant strains of PBCV-1 classified into the five antigenic classes were sequenced to a depth of >40X coverage using Roche 454 pyrosequencing technology. In addition, the wild-type genome of PBCV-1, which was first sequenced about 15 years ago, was re-sequenced as a part of this project. This greater depth of coverage uncovered several sequencing errors in the original wild-type genome sequence. The revised wild-type PBCV-1 sequence was used as the reference in the Roche software gsMapper<sup>®</sup> to assemble the sequencing reads of each of the 11 antigenic mutants into contigs. Among the 11 antigenic mutant strains, mutations were found in a total of 24 genes and 4 intergenic regions, most of which probably have nothing to do with the antigenicity changes. Two of the antigenic mutant strains were the result of >30 kb deletions involving genes long suspected of being involved in glycosylation-related events. Ten of 11 antigenic mutants of CDS A064R, a putative glycosyltransferase (mannosyltransferase), had either mutations within the gene or the entire gene was deleted. A secondary analysis of the 11 antigenic mutant strains carefully re-examined 20 individual genes suspected of encoding proteins involved in some biochemical event related to glycosylation. Surprisingly, none of the 11 antigenic mutants contained mutations in any of those 20 genes. Additional

focus is now being placed on CDS A064R, which encodes a protein with three domains. The categories of antigenic mutants may well be explained by mutations present within this one gene.

## SYSTEMS ANALYSIS OF SIGNAL TRANSDUCTION NETWORKS IN BREAST CANCER DEVELOPMENT

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Signal transduction is a process by which extracellular signals activate a myriad of biochemical pathways to induce a particular cellular response. A cell's complexity, namely in signal transduction, is not only a result of the large number of its components but also the immensely interconnected nature in which these components interact. Mutations within these biochemical networks can cause proteins to interact inappropriately, which can have catastrophic effects on the cell's function. Several diseases, including cancer, are associated with anomalies within signal transduction networks; however, the complexity of the cellular network makes the development of effective drug therapies very difficult. An effort to remedy this difficulty is using systems approach to monitor how a particular drug will affect the entire cell (as opposed to only the one drug target). Computational models and computer simulations have been used to examine signal transduction networks. Specifically, the advantage of computer models lies in the ability to simulate the cell under thousands of environmental conditions, including those resulting in disease. We constructed a large-scale dynamical model of a human mammary epithelial to better understand the mechanisms underlying breast cancer. Manually constructed from biochemical literature, the logical model is composed of a number of signaling pathways (ErbB receptor, E-cadherin, Integrins, G-protein coupled receptor, and stress components) with more than 240 components and 1,100 biochemical interactions (currently the largest dynamical model available). Using system-wide simulations of the model under healthy and diseased states, we identified proteins of the cells biochemical network that are most influential in mutagenic environments. This knowledge has the potential to facilitate exploration of new more efficient drug therapies.

## ASSESSING CORRELATIONS BETWEEN LYNCH SYNDROME AND B-CELL CHRONIC LYMPHOCYTIC LEUKEMIA

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Lynch Syndrome is the most common type of hereditary colorectal cancer. The underlying molecular mechanism of Lynch Syndrome is a defect in one or more of the DNA mismatch repair genes, most commonly MSH2 and MLH1. Because of this defect, the patients are unable to correct insertions and deletions that occur during the DNA replication process, resulting in high levels of microsatellite instability (MSI-high).

In addition to the development of colorectal cancer, patients with Lynch Syndrome are at an increased risk for the development of other cancers including cancers of the brain, bladder, liver, ovary, pancreas, endothelium, and stomach. Despite the increased rate of development of many forms of cancer in Lynch Syndrome patients, hematological malignancies have not been associated with the mutator phenotype observed in Lynch Syndrome patients.

Chronic lymphocytic leukemia (CLL) is the most common leukemia diagnosed in Western countries. Approximately 5% of CLL cases are familial in nature: the cause of the remaining cases of CLL is unknown. Exposure to ionizing radiation, alkylating agents or solvents does not appear to increase the likelihood of developing B-CLL. A number of cytogenetic abnormalities have been described in patients with CLL including trisomy 12 and deletions in the short arm of chromosome 17.

In 1996 Gauterhaus et al. described microsatellite instability in 2 of 29 B-CLL patients studied, suggesting that a subset of B-CLL patients had the mutator phenotype, thus placing these individuals at risk for Lynch Syndrome cancers. Because the DNA mismatch repair genes were not sequenced, it is not possible to know that the patients had the mutator phenotype observed in the Lynch Syndrome patients.

This observation does however support the hypothesis that CLL is a part of Lynch Syndrome cancers, at least in a subset of patients.

These studies were designed to examine the relationship between Lynch Syndrome and the most common hematological malignancy of the Western world, B-CLL. Identifying abnormally high rates of CD5 and CD19 proteins on cells' surfaces in LS patients would suggest a correlation between the cancers exists.

## STRUCTURE AND INTERACTION OF THE HUMAN HSP70-2 WITH PYRRHOCORICIN ANALOGS

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The highly conserved 70 kDa heat shock protein isotype 2 (Hsp70-2) can regulate apoptosis. Many cancer cells up-regulate Hsp70-2 to prevent stress-induced damage to cells. The inhibition of the activity of Hsp70-2 results in the apoptosis of only cancer cells. Hsp70-2 has a nucleotide binding domain (NBD) and a substrate binding domain (SBD). The SBD consists of  $\beta$ -sheets that form a pocket and an  $\alpha$ -helical lid and random meander tail. Although, the X-ray structure of the NBD has been determined, no structure of the SBD of Hsp70-2 has been reported. Therefore, the structure of the SBD of Hsp70-2 was determined with homology modeling using the experimental structure of DnaK, bacterial analog of Hsp70, as a template.

The 20 residue antimicrobial peptide, Pyrrohocoricin (Pyr, VDKGSYLPRPTPPRPIYNRN), binds DnaK. The first 10 residues of Pyr bind to the lid region of the SBD of DnaK. Therefore, the binding mode and free energy of binding of Pyr(1-10)-NH<sub>2</sub> to human Hsp70-2 was studied using molecular docking and Molecular Dynamics (MD) simulations. Furthermore, the contribution of each residue of Pyr(1-10)-NH<sub>2</sub> to binding was determined by using an Ala-scan methodology. Dockings were done with Glide XP software and MD simulations with GROMACS 4.5 package. 50 ns MD simulations of the three complexes with the lowest free energies of binding were performed with the OPLS-AA force field and TIP4P water.

MD simulations show that Pyr(1-10)-NH<sub>2</sub> and [Ala<sup>7</sup>]Pyr(1-10)-NH<sub>2</sub> formed stable complexes with the lid of Hsp70-2. These complexes were subjected to further MD simulations with the entire SBD. Simulations of the Pyr analogs showed restricted lid movement compared to the simulation of the free SBD.

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## EFFECTS OF WEIGHT REDUCTION ON LEPTIN SENSITIVITY IN DIET-INDUCED OBESE RATS

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The fat cell hormone leptin plays a central role in regulation of energy reserves. Changes in energy reserves produce corresponding changes in leptin signaling to the brain to affect energy intake and expenditure in order to regulate energy reserves. It is hypothesized that leptin sensitivity is reduced in obese subjects, and weight loss in obese subjects increases leptin sensitivity. Here we compared leptin sensitivity in age-matched lean, diet-induced obese (DIO), and DIO rats after a 10% weight loss. Leptin sensitivity was assessed by measuring leptin receptor signaling protein – phosphorylated signal

transducer and activator of transcription 3 (pSTAT3) – in the arcuate nucleus (ARC) by immunocytochemistry. ARC pSTAT3 signaling in response to leptin injection (125 nmol/kg IP) was significantly reduced in diet-induced obese (DIO) vs. lean rats, and in DIO vs. weight-reduced DIO rats. In contrast, pSTAT3 signaling was not different in weight-reduced DIO vs. age-matched lean rats. These results suggest that our DIO rats were leptin insensitive, and that a food-restriction-induced weight loss of 10% in the DIO rats normalized leptin sensitivity.

## BIOLOGICAL AND MEDICAL SCIENCES SESSION C

### TWO-PHOTON FLUORESCENCE INTENSITY AND LIFETIME IMAGING OF NADH REVEALS GLUCOSE AVAILABILITY IN CULTURED CELLS

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Investigation of the metabolic processes occurring within individual cells and tissues is a fundamental step towards gaining an understanding of the health of cells, tissues and organs of the body. Focusing on the endogenous fluorophore nicotinamide adenine dinucleotide (NADH), primarily localized in mitochondria within the cell, we use both steady state (intensity) and dynamic (lifetime) multiphoton imaging techniques to characterize the metabolic state of monolayer and multicellular tissue culture. Changes in cellular metabolism induced by the availability of glucose produce variations in fluorescence intensity and lifetime distributions that reflect changes in both NADH concentration and enzyme binding. Fluorescence Lifetime Imaging techniques provide new insights into cellular metabolism that methods relying on fluorescence intensity alone cannot reveal. This publication was made possible by Grant Number P20GM103427 from the National Institute for General Medical Science (NIGMS), a component of the National Institutes of Health (NIH) and its contents are the sole responsibility of the authors and do not necessarily represent the official views of NIGMS or NIH.

### INTENSITY- AND LIFETIME-BASED ANALYSES OF ENDOGENOUS DIFFERENCES IN NADH METABOLISM IN COCHLEAR HAIR CELLS

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According to the World Health Organization, hearing loss (HL) is the most frequent sensory deficit in global populations. Of the two types of sensory cells housed within the cochlea, inner hair cells (IHCs) are significantly more resilient than outer hair cells (OHCs) when exposed to acoustic trauma, age-related HL, or ototoxins. By examining changes in the fluorescence of the intrinsically fluorescent metabolic intermediate nicotinamide adenine dinucleotide (NADH), we were able to uncover innate differences in IHC and OHC mitochondrial metabolism. We studied both the fluorescence lifetime and intensity of NADH in IHCs and OHCs using an in vitro mouse model. When comparing IHCs and OHCs, IHCs displayed longer NADH lifetimes, and OHCs exhibited greater concentrations of NADH. In addition to examining endogenous differences in IHC and OHC metabolism, we also used this technique to study how ototoxic antibiotics, like gentamicin, alter HC metabolism. The NADH fluorescence lifetime imaging technique was used to determine if gentamicin-induced decreases in NADH fluorescence are due to (1) a decrease in the total amount of NADH present or (2) if NADH fluorescence lifetimes shorten when NADH binds to different substrates, which then results in a decrease in NADH fluorescence. Understanding the metabolism of cochlear hair cells is important for preventing and treating hearing loss. This research was conducted at the Integrative Biological Imaging Facility at Creighton University, Omaha, NE. This facility, supported by the C.U. Medical School, was constructed with support from grants from the National Center for Research Resources (5P20RR016469) and the National Institute for General Medical Science (NIGMS) (8P20GM103427), a component of the National Institutes of Health (NIH). This research was

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## THE EFFECTS OF DYNAMIN-DEPENDENT ENDOCYTOTIC INHIBITION ON $\text{Ca}^{2+}$ CHANNEL MOBILITY IN RIBBON SYNAPSES OF TIGER SALAMANDER RETINA

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Specialized structures, known as ribbons, exist in rod cells allowing for the focused movement of vesicles in the pre-synaptic cell.  $\text{Ca}^{2+}$  channels are localized beneath these structures to facilitate quick release of vesicles in normal vision. However, it has been shown that with addition of membrane due to vesicle fusion can cause these channels be more mobile. By blocking the re-uptake of membrane using a dynamin inhibitor (dynasore), we predict that the confinement area of these channels will increase. Retinal slices were collected from *Ambystoma tigrinum* and labeled with an antibody against the  $\alpha_2\delta_4$  subunit of the  $\text{Ca}^{2+}$  channel. We then labeled this with a biotinylated 2° antibody and streptavidin-coated quantum dot, allowing us to track the movement of the channels. Our results showed that the confinement area of the  $\text{Ca}^{2+}$  channels increased in cells treated with dynasore. This suggests that when endocytosis is blocked, the surface area of the cell beneath the ribbon increases, causing  $\text{Ca}^{2+}$  channels to spend more time away from the ribbon. Thus, after dynasore treatment, it may be necessary to open more  $\text{Ca}^{2+}$  channels to elicit the same release as in control cells.

## DEVELOPMENT OF A WATER-SOLUBLE FLUORESCENT CHEMOSENSOR FOR DETECTION OF BIOLOGICALLY RELEVANT ANALYTES

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Metal ions are known to be vital contributors to cell and tissue signaling. In particular, divalent zinc has been shown to be important for regulating protein transcription factors and immunological processes. Additionally, zinc is suggested to be involved in insulin secretion, and disruption of zinc homeostasis may have consequences in type-two diabetes. Because  $\text{Zn(II)}$  can not be detected directly by spectroscopic methods, it is necessary to develop tools such as fluorescence chemosensors to measure the presence and concentration of this important analyte. Recently, dicarboxylated derivatives of 1,3-bis(*meta*-aminophenylethynyl)benzene were shown to selectively detect aqueous  $\text{Zn(II)}$ ,  $\text{Cd(II)}$ , and  $\text{Pb(II)}$  via a fluorescence shift from 350 to 393 nm and signal intensification upon cation binding. The proposed mechanism for analyte detection was the conformational restriction of freely rotating arenes. However, fluorescent signal faded shortly after binding of analyte. It was hypothesized that the loss of signal was the result of a decrease in aqueous solubility of sensor-analyte complex relative to the free sensor and cation. The goal of this study was to address these solubility issues via the addition of glycol chains to the sensor. Diglycolated resorcinol units were prepared by reaction between resorcinol and tosylated glycols in refluxing acetonitrile and potassium carbonate base. Following diiodination at the 2- and 4- positions of the resorcinol ring with N-iodosuccinimide and Sonogashira coupling with *meta*-ethynylaniline, condensation with each of three cyclic anhydrides gave the desired glycolated sensors. Products were characterized by  $^1\text{H}$  NMR, MALDI-TOF MS, and UV-visible absorbance and fluorescence spectroscopy. High throughput fluorescent binding assays were used to screen the glycol-sensor derivative against a number of divalent cations. Details of the synthesis, characterization, and fluorescent screening assays will be presented.

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## DEVELOPMENTAL PLASTICITY OF METABOLIC RATE IN ORGANISMS WITH COMPLEX LIFE-CYCLES CAN CARRY OVER INTO ADULTHOOD

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Variation in environmental conditions experienced during development can cause variation in developmental trajectories leading to differences in adult phenotypes. Complex life-cycles are thought to be able to decouple life history stages and allow phenotypes to be expressed independently between life stages. Metabolic rate is an integrative measurement of body condition and varies in response to environmental conditions. Metabolic carry-over effects have been demonstrated in vertebrates with simple as well as with complex life-cycles. Here I investigate the developmental plasticity of metabolic rate of an invertebrate with a complex life-cycle.

## DEGENERATION OF AN ANCIENT RED ALGAL GROUP II INTRON

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Spliceosomal introns are ubiquitous in eukaryotes, yet their origins remain controversial. The leading hypothesis is that they arose from the degeneration of self-splicing mobile elements called group II introns. Yet, this process is not well understood. In this study we are examining the pattern of degeneration found in an exemplar group II intron located in the plastid *psaA* gene of one class of red algae (Stylonematophyceae). This intron has been vertically inherited for more than one billion years, making it the oldest known group II intron. It varies in size (382-585 nt) and lacks many of the tertiary interactions that are conserved in other group II introns. For these reasons, it is an unusual intron and an ideal system for studying group II intron degeneration. The goal of the project is to characterize structural and functional degeneration of this intron in an evolutionary context. To do this the secondary structures of eleven introns were determined and a subset of these were cloned and tested for *in vivo* and *in vitro* splicing ability. Intron structural features and splicing ability were then mapped on a phylogeny of Stylonematophyceae constructed from *psaA* sequences. Of the introns that were tested, they appear to either splice poorly or not at all. As evident by structural comparisons, the intron has unique degeneration patterns in different lineages. These results suggest that there are multiple pathways by which group II introns degenerate. This work was made possible by Grant Number P20GM103427 from the National Institute for General Medical Science (NIGMS), a component of the National Institutes of Health (NIH).

## SYNTHESIS AND ASSEMBLY OF DNA CONSTRUCTS FOR COMPLEMENTING MUTANTS DEFICIENT IN RNA INTERFERENCE IN GREEN ALGAE

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RNA interference (RNAi) is a highly conserved mechanism of gene expression regulation in eukaryotes. Since its discovery, RNAi has been primarily utilized as a method for studying gene function in reverse genetics, though its potential for application is much greater. Proposed technologies are widespread: from being used as a therapy for genetic diseases to transgenic crops. However, the basic RNAi mechanisms are just beginning to be explored and an understanding of them is necessary to design improved, RNAi-based technologies. We are using the unicellular green algae *Chlamydomonas reinhardtii* as a model organism for the study of RNAi mechanisms. In this alga, we have identified an RNAi-defective strain, MUT116, in which a deletion in a gene encoding a putative RNA helicase appears to be the cause of the mutant phenotype. Utilizing reverse transcription polymerase chain reaction (RT-PCR), the complementary DNA (cDNA) of the helicase gene was synthesized then

assembled and cloned into the pSTBlue-1 vector for analysis. This analysis and information on MUT116 strain will be presented.

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## EFFECT OF MANGENESE AND NITROGEN DEPRIVATION ON LIPID ACCUMULATION IN CHLAMYDOMONAS

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With dwindling reserves, increasing costs, political instability, and climate concerns all threatening the future of fossil fuels; biofuels are becoming an appealing alternative. Biofuels can be produced from a number of different plant-based sources. Amongst these are a number of prospective algal species including the model system *Chlamydomonas reinhardtii*. It has been shown that the nitrogen source and its availability affects the production of triglyceride droplets that can be used for biofuels. In this study, we characterize the timeline of lipid droplet deposition using Nile Red when cultures are deprived of manganese, nitrogen, or both. Manganese deprivation was chosen because of its role as a cofactor in superoxide dismutase. Removal of manganese should provide oxidative stress, which is also known to incite lipid accumulation. Our goal is to show whether manganese deprivation alone or in combination with nitrogen deprivation will cause a higher level of lipid accumulation than nitrogen deprivation alone. The project was funded in part by the NSF-EPSCoR program grant “Nebraska 2010-15 RII Project: Nanohybrid Materials and Algal Biology” (award number EPS-1004094). Microscopy facilities were supported by a grant from the INBRE program (1P20RR164169).

## INTERACTIONS OF HOPVI IN A TYPE THREE SECRETION SYSTEM

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Type three secretion systems are needle-like projections found in Gram-negative bacteria. They allow the bacteria to first detect possible host cells, and second infect these cells by allowing a pathway to the inside of the host cells where effector proteins can travel and cause infection. This paper focuses on the bacteria *Pseudomonas syringae* and one of its effector proteins, HopVI.

Effector proteins may serve a variety of functions that help cause disease in host cells by encouraging uptake, inducing apoptosis, or suppressing immune system activity. *P. syringae* can infect a wide range of host plants; for our experiments, we used Arabidopsis. In these plants, innate immunity can occasionally recognize non-host effector proteins and trigger an innate immunity response. This may lead to hypersensitive response (HR) to minimize the area of infection, and a rise in reactive oxygen species (ROS) in an attempt to strengthen the cell wall.

We believe from ROS activity in plant samples treated with HopVI that this effector protein has the ability to suppress the host’s innate immunity, allowing the infectious effector proteins to more effectively cause disease.

The pathway taken by effector proteins into host cells is mostly known, though there are some specific details that remain mysterious, and some proteins may take different paths than others. We propose ShcV as a possible chaperon for HopVI, given its location on the genome and notable interactions with the protein. From a yeast two-hybrid assay, we have narrowed down regions on the HopVI protein most likely to be binding sites with ShcV. From there, we have proposed to model systems to show specific structures of the protein-chaperon complex. Based on other effector protein-chaperon binding pairs, we believe Model 2, the homodimer, to be more probably, though further tests to discover more specific regions of binding between the proteins are necessary.

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#### TYPE III EFFECTORS OF *PSEUDOMONAS SYRINGAE* INDUCE A SECRETION-DEPENDENT REDUCTION IN HOST HISTONE H3 ACETYLATION

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*Pseudomonas syringae*, a gram-negative plant pathogen, requires a type III secretion system (T3SS) in order to cause disease in the model organism *Arabidopsis thaliana*. The T3SS, essentially a molecular syringe found in many bacterial pathogens, allows the injection of proteins called type III effectors (T3Es) into host cells. While the specific molecular function of most *P. syringae* T3Es is unclear, many contribute to disease development in plants by suppressing elements of the plant innate immune response. Our work has focused on determining if T3Es of *P. syringae* are involved in modulating host chromatin and thereby the expression of innate-immunity related genes to favor disease progression. To evaluate whether *P. syringae* induces T3SS dependent chromatin modifications in *Arabidopsis*, we vacuum infiltrated plant leaves with the wild type pathogen, a mutant strain incapable of injecting T3Es, and a buffer only control treatment. Immunoblot analysis of tissue harvested at timed intervals with antibodies designed to detect specific histone modifications revealed a T3SS dependent decrease in histone H3K9 acetylation (H3K9Ac) after a 15-hour period of infection. Subsequent chromatin immunoprecipitation assays combined with quantitative-PCR (qPCR) showed that this reduced H3K9Ac was found along a subset of innate immunity related genes. This change was absent in plants exposed to the secretion defective mutant. H3K9Ac is associated with actively transcribed regions of the genome, and we have correlated reduced acetylation with lower levels of mRNA transcripts for the genes involved. We are using *P. syringae* mutants defective in subsets of effectors and a closely related non-pathogen *P. fluorescens* engineered to express a T3SS complemented with different T3Es to determine the effector(s) responsible. Preliminary data suggest that during infection, the T3Es of a single pathogenicity island directly or indirectly reduce H3K9Ac along a subset of immunity related genes. We are currently working to define the role these specific effectors play in enhancing virulence.

#### BIOLOGICAL AND MEDICAL SCIENCES SESSION D

#### FUNGAL DIVERSITY OF A COTTONWOOD ROOT SYSTEM

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Mycorrhizal fungi are symbiotic partners of plants that facilitate nutrient uptake. Historically, most research on mycorrhizal fungi has been based on the microscopic examination of morphology. A better estimate of diversity can be obtained using molecular techniques, as even fungi that appear identical often vary at the molecular level. In our research, we use environmental PCR to investigate fungal diversity in a single cottonwood tree. Based on morphological evidence, cottonwood trees (*Populus* spp.) are known to harbor both major classes of mycorrhizal fungi (ectomycorrhizae and arbuscular mycorrhizae [AMF]). This is unusual, making cottonwoods a model system for studying mycorrhizal diversity. In addition, cottonwood trees have extensive networks of roots, which intercept soil layers varying in texture, organic matter, and water content. Therefore, we expect the assemblage of fungi to differ throughout this root network. DNA was extracted from four spatially distinct locations within the root system of a single cottonwood tree. Using PCR, a 1.4 kb region of the internal transcribed sequence and large subunit of the ribosomal RNA was amplified, cloned and sequenced. Our results are based on more than 100 total fungal sequences. The sequences fall into two general



categories, ectomycorrhizal fungi and other non-mycorrhizal fungi. The ectomycorrhizae are relatively homogenous with an average sequence identity of 93%. These fungi are closely related to other uncultured ascomycete fungi, belonging to the family Tuberaceae. In our study, the ectomycorrhizae are preferentially found on roots near the surface, while fungi at lower depths tend to be general soil fungi that have not been previously identified as mycorrhizae. The lack of arbuscular mycorrhizae was surprising, so we also used AMF-specific primers to target these fungi. Even then, only one AMF sequence was obtained. We therefore conclude that despite morphological evidence, arbuscular mycorrhizae play a minimal role in nutrient uptake in cottonwood trees. This work was made possible by Grant Number P20GM103427 from the National Institute for General Medical Science (NIGMS), a component of the National Institutes of Health (NIH).

#### ANTIBIOTICS FROM NATIVE PLANTS FOR USE AGAINST MRSA

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Methicillin resistant *Staphylococcus aureus* (MRSA) is a severe and growing health care concern throughout the United States. We are attempting to find new antibiotics from native plants that will impede the growth of MRSA. Native plants were selected on the basis of their reported use against boils and other skin infections in the oral tradition of the Lakota people. *Zigadenus venenosus*, Death Camass, members of the *Astragalus* genus, and members of the *Oxytropis* genus were collected on Lakota tribal lands with the permission of Lakota elders. An introduced plant, *Ranunculus testiculatus*, was also collected because of the availability of the plant and previous interest in this plant and its toxicity. MRSA was obtained from Veterans Hospital in Hot Springs, South Dakota, and the Indian Health Hospital in Pine Ridge, South Dakota. Potential MRSA specimens were Gram stained and tested on Staphyloslides to assure that they were *S. aureus*. *S. aureus* samples were further tested using the Kirby Bauer method to determine if the bacteria were methicillin resistant. MRSA and non-methicillin resistant *S. aureus* samples were then tested against plant extracts using Kirby Bauer testing to determine if the bacteria strains were susceptible to potential antibiotic compounds produced by our plant specimens. Extracts of *Ranunculus testiculatus* had the ability to impede the growth of non-methicillin resistant *S. aureus* and, to a lesser extent, MRSA. The seed pods of *Ranunculus* were particularly potent in the production of a potential antibiotic against MRSA. This potential antibiotic will be further purified and tested to determine its potency.

#### IDENTIFYING GENETIC MECHANISMS RESPONSIBLE FOR LOSS OF PIGMENTATION IN *IOCHROMA CALYCINUM*

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Anthocyanins are plant pigments that make flowers and fruits red, blue, or purple. The differences in color are caused by variation in the function of the anthocyanin pathway. The aim of this project is to determine the genetic mechanisms responsible for the loss of anthocyanin production, which generates white flowers. The organism studied is *Iochroma calycinum*, a species in the tomato family that yields both purple and white flower morphs. Our hypothesis is that the loss of anthocyanin production could result from loss of function mutations in anthocyanin pathway genes. We sequenced coding regions from the eight genes required for anthocyanin production from both morphs. We conducted functional assays of fixed differences using heterologous expression in *E. coli*. Thus far it appears that DFR is the only gene carrying a fixed difference of functional significance, an 11 amino acid deletion near the active site of the enzyme. This deletion eliminates enzyme activity in the functional assay. The production of white flowers in the normally purple-flowered *I. calycinum* may be due to a loss of function mutation in DFR. This would be one of the few cases in which a structural mutation in the pathway has been associated with natural variation in flower color. We need to examine the rest of the pathway to rule out the potential contribution of structural mutations in other genes and

compare gene expression between purple and white individuals to eliminate the possibility that differential expression plays a role.

#### A BUTTERFLY POPULATION CENSUS AT HITCHCOCK NATURE CENTER

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During the summer of 2011, we collected data on butterfly populations and their nectaring plants at Hitchcock Nature Center in Honeycreek, Iowa. Four Pollard transect counts were conducted during the months of June to August. Our transect included three sections, along the Badger Ridge and Hidden Valley trails, and an Overlook area near the main lodge. Our transects contained a range of habitats, including forested ridge tops, clearings, prairie restorations, and forested bottomlands and slopes. The commonest butterfly species observed were the Cabbage White, Hackberry Emperor, Great Spangled Fritillary, Orange Sulphur, and Tawny Emperor; the most-visited nectaring plants were Hemp Dogbane, Tall Hedge Mustard, Common Milkweed, White Sweet Clover, and Ironweed. While some species were abundant in all sections of the transect, others were primarily present in specific habitat types. Seasonal changes in abundance of the various species were also noted.

#### THE DEVELOPMENT OF GRAPH THEORETIC TOOLS FOR ANALYZING AND VISUALIZING OF BIOLOGICAL DATA

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With the continuous advancements in biomedical technologies, biological data are being generated at an exponential rate. For the last decade, biomedical researchers have been focusing on issues related to generating and storing such massive data. Recently, with the emergence of Bioinformatics algorithms and tools, attention has been gradually shifting from a pure focus on data generation to a new focus on data analysis and data visualization. The utilization of data analysis tools allows researchers to extract useful information from the massive raw data currently available in public databases. As a result, data mining algorithms and visualization tools are quickly moving to the forefront of biomedical research. In particular, graph theoretic approaches are emerging as the methods of choice of many researchers to model the relationships of the various biological elements associated with a particular domain. In this study, we develop a graph theoretic approach for modeling and integrating large-scale biological datasets. The proposed approach is particularly useful when dealing with heterogeneous datasets representing different types of biological relationships. We utilize various analysis and visualization tools to study the graphs constructed from the raw biological data and propose the utilization of different graph properties to extract biologically relevant knowledge from the graph models.

#### DICER: CAN'T DANCE WITH OUT IT!

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Dicer, a ribonuclease type III, is required to process small regulatory RNAs such as microRNA (miRNA). Dicer and its regulation of miRNA function is involved in essential cellular processes such as differentiation, survival, and apoptosis. Our study investigates the role of Dicer and miRNAs in the neurogenesis, neuronal differentiation, and neurodegeneration of the cerebellum. To analyze these effects, conditional Dicer null mutants under the control of developmentally regulated promoter, *Atoh1*, have been generated in mice. *Atoh1* is expressed in and regulates neurogenesis of granule cells in the cerebellum. *Atoh1*-Cre Dicer null mice demonstrate unsteady ataxic behavior, disrupted gait, and extreme seizures. Statistical analysis of motor behavior was conducted using the Catwalk imaging

system. Results show a significant difference in initial paw contact time between the mutant and wild type mice ( $p = 0.0004$ ). Further, mutant mice demonstrate an increase in maximum paw contact ( $p = 0.0003$ ) and in paw angle relative to the horizontal plane ( $p = 0.0013$ ). These data suggest a loss of balance and coordination in mutant mice due to disruption of normal development and/or neurodegeneration. Confocal immunohistochemical analysis of cerebellar tissue from Atoh1-Cre Dicer null mice demonstrate a disruption in migration and development of cells layers in the cerebellum. RT-PCR and western blot analysis confirms a significant decrease in mRNA and protein expression of Zic2 in mutant mice as compared to controls ( $p \leq 0.05$ ). Loss of Zic2 expression is correlated with increased expression of activated caspase 3, suggesting that granule cells are undergoing apoptosis following excision of Dicer and a loss of miRNA function. Calbindin protein levels are not significantly different in mutant and wild type mice suggesting that Purkinje cell numbers are not affected directly in mutant mice. Preliminary RTPCR data suggest a decrease in Zic 2 and Calbindin expression levels and an increase in Caspase 3 expression levels in Atoh1-Cre Dicer null mice as compared to controls. Taken together, these data suggest that Dicer and miRNA play an important role in neurogenesis, neuronal differentiation and migration, and neurodegeneration in the cerebellum.

#### NEUROTROPHIC EFFECTS OF MICROGLIA VIA ACTIVATION OF AKT SIGNALING AND EPIGENETIC MODIFICATION

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Microglia are the resident immune phagocytic and secretory cells in the central nervous system. Under certain conditions, activation of microglia triggers neurotoxic inflammatory responses but research also suggests that activated microglia can play a role in neuronal survival and neurogenesis. The underlying mechanisms and properties of microglial neurotrophic activity are not understood. In this study, we utilize an *in vitro* model system previously developed in our laboratory to investigate neuronal responses to effector microglia. In our culture system, microglia grown on Transwell™ membranes are suspended above mechanically damaged or undamaged primary neuronal cultures. Increased proliferation was observed in damaged neurons after co-culture with effector microglia compared to those that were not. ELISA analysis of conditioned media from the co-cultures of damaged neurons with microglia displayed a significant increase in the levels of MCP-1, RANTES and MIP-1  $\alpha$  and a significant decrease in the content of IFN- $\gamma$ , TNF- $\alpha$  and IL-6. Increased expression of nestin, alpha internexin, and GFAP were detected in the co-cultured damaged neurons compared to controls as assessed by immunocytochemistry and western blot analysis. Western blot analysis also showed that the AKT signaling pathway was preferentially activated in damaged neurons co-cultured with activated microglia. AKT inhibitors attenuated the induced expression of nestin, alpha internexin, and GFAP. While the MAPK pathway is also enhanced in neurons following co-culture with microglia, this enhancement is not specific to neuronal damage and inhibition of this pathway does not block microglial-enhanced neurogenesis. Epigenetic modifications to both neuronal and microglial histone proteins is associated with enhanced neurogenesis in damaged neuronal cultures co-cultured with effector microglia. The above data suggests that microglia may possess modifiable neurotoxic and neurotrophic properties, making them potential targets for neuroprotective therapies. Moreover, microglial secretion may activate the AKT signaling pathway to promote neuronal proliferation and survival after injury. Understanding the mechanisms that drive neurotrophic processes may help develop immune therapies that promote neurogenesis and neuronal survival during neurodegenerative diseases and traumatic brain injury.

#### IMPACT OF OMEGA 3 AND OMEGA 6 FATTY ACIDS ON PS1, PS2, GFAP, AND NICAISTRIN LEVELS IN SPRAGUE DAWLEY RATS

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Alzheimer's disease (AD) is a degenerative neuropathy that is associated with extensive neuronal death. The Amyloid- $\beta$  1-42 (A $\beta$ 42) is thought by many to be the main contributing factor of this neuronal death and senile plaque buildup within the hippocampus of the brain. The presenilins (presenilin-1 (PS1) and presenilin-2 (PS2)) play an important role in the  $\lambda$ -secretase complex that cleaves Amyloid-precursor protein (APP) within the membrane. Research shows that mutations in the PS1 increase the levels of A $\beta$ 42. Nicastrin is also a part of the  $\lambda$ -secretase complex. PS1 and PS2 are believed to perform the actual cleavage of APP, Nicastrin's role is to stabilize the complex itself. Glial Fibrillary Acidic Protein (GFAP) has been seen in postmortem brain tissue of Alzheimer diseased patients. We fed isocaloric diets to different groups of Sprague Dawley rats. One diet was high in omega 3 fatty acids, one high in omega 6 fatty acids and a control that mirrored the omega 3 and 6 proportion of standard rat chow. We then harvested brain tissue from these rats, and analyzed them using a Western Blot analysis. We found slightly higher levels of PS1, PS2 and GFAP in the omega 6 group suggesting that a high omega 6 diet affects production of Alzheimer's disease related proteins and could possibly play a role in regulating A $\beta$ 42 development within brain tissue.

#### POLYMORPHIC A $\beta$ PROTOFIBRILS EXHIBIT DISTINCT CONFORMATIONAL DYNAMICS AS CALCULATED BY NORMAL MODE ANALYSIS

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This project proposes to test the hypothesis that the physicochemical milieu modulates the conformational dynamics of synthetic Alzheimer's Ab protofilament structures, the main component of Alzheimer's senile plaques. To this end, 3D solid-state NMR structures of Ab protofilaments were used as initial structures for molecular dynamics simulations in explicit water and a water/hexane environment. The initial structures of the simulations and representative structures from the simulation-generated trajectories were taken to perform computational normal mode analysis. We developed a code in python with a graphical user-friendly interface. The program incorporated the ProDy (0.7.1) package. With the application, we examined cross-correlation plots of Ca positions of the 2-fold Ab protofilaments along the most collective mode and the slowest mode. The protofilament structures were highly correlated in the water environment. We hypothesized the protofilament would move as one in water because of the viscosity. The square fluctuation of Ca positions was calculated for the slowest mode for the hexane model and the MD generated ensemble. The two plots match up until midway through the structure. At the midway point a phase shift emerged between the two structures most likely where the surrounding changes. The in-house developed code made it easy to perform analysis and will be used by other students in the research group.

#### BINDING MODES OF AGAAAAGA TO SYRIAN HAMSTER PRION PROTEINS

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Many cells express certain proteins called prion proteins. It is known that prion proteins are involved in copper binding but their exact function is still uncertain. If a specific misfolding of these proteins happens, prions are created. Prions are able to induce misfolding, which allows them to propagate the condition. If a misfolding cascade forms into an aggregate, it can cause a neurodegenerative disorder. As a group, these diseases are known as transmissible spongiform encephalopathies (TSEs). The AGAAAAGA sequence was specifically identified as an inhibitor that binds to the monomer prior to conversion. We sought to determine what specific region of the prion protein is most conducive to AGAAAAGA peptide binding. Three initial peptide conformations were tested, generated by the Robetta server. Then, docking calculations were performed on recombinant Syrian hamster prion protein using the free software Autodock 4.2 to identify binding modes. We then processed the data using a more refined free energy method. We found that the second and third  $\alpha$ -

helices play an important role in “tying” these helices together. We also found that the ligand does not bind to the homologous sequence.

#### **ANALYZING BIOLOGICAL NETWORKS USING GRAPH ALIGNMENT**

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With the advancements in sequencing technologies and the tremendous development in computing capabilities, it is now possible to construct large-scale biological networks to employ a systems biology approach in solving various problems in computational biology. Some examples of such networks include protein-protein interaction networks, correlation networks, and gene-disease networks. To analyze the constructed biological networks, many graph alignment algorithms have been developed to study the similarities and dissimilarities among their various modules. These algorithms not only use sequence similarity, but also take into account the topology and the structure of the biological networks when attempting to align different network components. By utilizing graph alignment algorithms, phylogenetic relationships as well as functional modules of different biological elements can be uncovered. However, this process faces several challenges. First, the constructed networks are often very large and their noise-to-signal ratio is rather high. In addition, due to the wide range of alignment algorithms currently available, the results of aligning biological networks, particularly the large ones, often vary depending on the algorithm implemented. As a result, several network filters have been proposed to reduce the network size and attempt to filter out noisy relationships among the network elements. Filtering biological networks involves using network algorithms, graph theoretic properties, and ontology enrichment to emphasize clusters and pathways of biological relevance. These highly conserved modules found within multiple biological networks often signify vital clusters and pathways that can lead to new discoveries. In this project, we conduct a comparative study among several graph alignment algorithms and use the results to evaluate the effectiveness of a number of network filters techniques. We test the proposed method on different biological datasets and validate the results using available literature and ontology databases.

#### **CHEMISTRY AND PHYSICS CHEMISTRY**

#### **AN INVESTIGATION OF THE DELIQUESCENT AND EFFLORESCENT PROPERTIES OF MIXED SODIUM CHLORIDE AND SODIUM SULFATE AEROSOLS USING INFRARED SPECTROSCOPY**

Joshua P. Darr, Shannon Q. Stoffel, Yohei Kohno, and Kevin McKenna, Department of Chemistry, University of Nebraska at Omaha, Omaha, NE 68182

A flow-cell apparatus coupled to an infrared spectrometer has been used to characterize the deliquescent and efflorescent properties of internally mixed sodium chloride and sodium sulfate aerosols. Mixtures of 33%, 58%, and 75% mole fraction sodium sulfate have been studied. In accord with predictions of the Gibbs-Duhem equation, the deliquescence relative humidity of the mixtures is found to be lower than those of either of the pure compounds. A comparison of the experimental results to those from calculations based upon thermodynamic models has also been made. The experimental deliquescence relative humidities are found to be lower than those predicted by the models. When examining the aerosols' efflorescence, the hysteresis behavior typically observed is more prominent with the 75% sodium sulfate solution than with either the 33% or 58% solution.

#### **STUDY OF PERMALLOY/BISMUTH/PERMALLOY NANOFUNCTIONS FOR SPIN VALVE DEVICES**

Benjamin B. Wymore and J. G. Redepenning, Department of Chemistry; and A. Sokolov, Department of Physics, University of Nebraska-Lincoln, NE 68588

Spin valve devices are described by the Nobel Prize winning effect Giant Magnetoresistance (GMR) which typically involves an atomically thin nonmagnetic metal layer that has no scattering events sandwiched between ferromagnetic layers. The magnetization of the ferromagnetic layers affects the total resistance of the device. At a certain magnetic field, the magnetic layers will have antiparallel magnetizations that would cause resistance to the transfer of both electron spins from one magnetic layer to the other. If the magnets have parallel magnetizations, the majority electron spin transfers through the nonmagnetic layer with less resistance resulting in a relatively lower resistance than the antiparallel configuration. A search for a larger effect is underway as current applications depend on smaller magnetic particles for detection such as magnetic read-heads used in hard drives which may be achieved by reducing the nonmagnetic layer size in the x, y, and z directions. This study incorporated bismuth as the nonmagnetic layer between two ferromagnetic permalloy (0.8Ni0.2Fe) leads. Bismuth has a large electron mean free path (1 nm) compared to other metals (~1 nm) at 4.2K, ideally providing a simple fabrication process into obtaining ballistic spin transport. Bismuth was electrochemically deposited between ellipse shaped permalloy leads separated by ~100nm. An external magnetic field was applied to the device displaying a -0.1% MR effect at the permalloy coercivity, which was superimposed onto the parabola shaped ordinary magnetoresistance response of bismuth.

#### **CRYSTALLINE $\alpha$ -SAMARIUM SESQUISULFIDE SEMICONDUCTING NANOWIRES**

Chris M. Marin, Lu Wang, Hsin-Yu Liu, Mike S. Thompson, Joseph R. Brewer, Wai-Ning Mei, and Chin-Li Cheung, Department of Chemistry, University of Nebraska–Lincoln, NE 68508; and Department of Physics, University of Nebraska, Omaha, NE 68182

We report the chemical synthesis of  $\alpha$ -phase samarium sesquisulfide ( $\alpha$ -Sm<sub>2</sub>S<sub>3</sub>) nanowires for the first time. These nanowires are highly crystalline with diameters down to 20 nm and a preferential [010] crystal growth direction. UV-Vis spectroscopy was used to investigate the presence of the band gap of this nanomaterial. The band edge found at 700 nm was similar to the previously reported values for bulk  $\alpha$ -Sm<sub>2</sub>S<sub>3</sub>. Density functional theory calculations were employed to investigate the band gap for both ideal and sulfur-deficient  $\alpha$ -Sm<sub>2</sub>S<sub>3</sub> for comparison with experimentally observed properties. We propose a vapor-solid-solid mechanism to explain the formation of these nanowires during the chemical synthesis process.

#### **ENTRAPMENT OF NANOMATERIALS FOR USE IN HPLC AND FLOW-BASED ANALYSIS METHODS**

Erika Pfaunmiller and David S. Hage, Department of Chemistry, University of Nebraska–Lincoln, NE 68588-0304; and Stephen Gross, Department of Chemistry, Creighton University, Omaha, NE, 68178

Affinity chromatography is an important and useful tool for studying biological interactions, such as the binding of an antibody with an antigen. Monolithic supports offer many advantages over traditional packed bed supports in affinity chromatography, including their ease of preparation, low back pressures and good mass transfer properties. Monoliths can be broken down into two basic categories: organic (polymer) and inorganic (silica) monoliths. There are many varieties of polymer based monoliths; however, a large focus has been on co-polymers of glycidyl methacrylate (a functional monomer) and ethylene glycol dimethacrylate (a cross-linking agent). The solvents of choice for making this type of monolith are typically 1-dodecanol and cyclohexanol. This particular study utilized a monolith comprised of a co-polymer of glycidyl methacrylate and ethylene glycol dimethacrylate to examine the effectiveness of this material to entrap carbon-based nanomaterials for eventual use in characterizing such materials or using them in separations based on biologically-relevant proteins or ligands.

## **KINETIC ANALYSIS OF THE CHEMICAL VAPOR DEPOSITION POLYMERIZATION (CVDP) OF CYCLIC LACTONES INITIATED BY ZINC OXIDE (ZnO) USING A QUARTZ CRYSTAL MICROBALANCE (QCM)**

Kris Hiebner and Jody Redepenning, Department of Chemistry, University of Nebraska–Lincoln, Lincoln, NE 68588

In chemical vapor deposition polymerization (CVDP), a monomer precursor is heated in the presence of a nucleophilic substrate. The monomer enters the vapor phase where it comes into contact with the substrate. At the substrate surface it adsorbs and one of two results can occur. The monomer can react at the surface or desorb and reenter the vapor phase. Over time a thin polymer film is produced that becomes thicker as the reaction proceeds. Because the substrate does not come into contact with the liquid monomer, excess monomer does not accumulate and consequently need not be removed. The CVDP process results in a polymer film that is free of residual solvent, thin, uniform, and directly bonded to the substrate. These advantages make CVDP the ideal method for coating porous, complex substrates. Recently our group has shown that CVDP can be used to coat porous hydroxyapatite scaffolds with various bioresorbable polylactones. The resulting composite displayed improved mechanical properties over the uncoated scaffold while maintaining the porous structure, which is important for soft tissue growth and bone regeneration.

The quartz crystal microbalance (QCM) is an ideal method for the kinetic analysis because the rate of the polymer film growth can be measured in real time, it offers good sensitivity, and it can detect small mass changes in real time, as low as  $1 \text{ ng/cm}^2$ . The QCM relies on the piezoelectric properties of quartz crystal to gain its sensitivity. Applying an oscillating electric field across the thin quartz wafer induces an acoustic wave which propagates perpendicular to the surface. This resonant frequency is dependent on the thickness of the quartz crystal. Sauerbrey was the first to exploit this phenomenon for purposes of measuring small mass changes. He made the assumption that for small mass changes, the addition of foreign mass could be treated as the addition of an equivalent mass of quartz, and therefore thickness of the quartz crystal. This presentation will focus on the kinetic analysis of the CVDP of the cyclic lactones, L-lactide and glycolide, initiated by Zinc Oxide (ZnO) through the use of a QCM. The rate of polymerization at various temperatures is investigated and it is found that as the temperature increases, the reaction rate increases. This increase in polymerization rate is due to both an increase in the vapor pressure of the monomer and an increase in the thermal activation.

## **A SYNTHESIS OF PEROXIDE CONTAINING FATTY ACIDS**

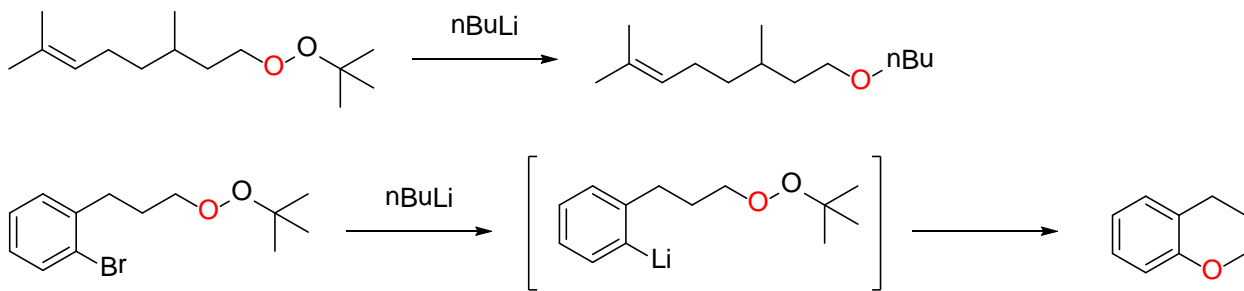
Jesse Joyce, Michael Richardson, and Patrick Dussault, Department of Chemistry, University of Nebraska–Lincoln, NE 68588-0304

Our laboratory is interested in analogs of fatty acids incorporating reactive components. My talk will describe the synthesis of peroxide-containing analogs of fatty acids which are of potential interest as reactive coatings and as potential antimicrobial agents.

## **UTILIZING PEROXIDES FOR NOVEL C-O BOND FORMATION**

Benjamin W. Puffer and Patrick H. Dussault, Department of Chemistry, University of Nebraska–Lincoln, NE 68588

Aliphatic and cyclic ethers are important classes of molecules in chemistry. Their synthesis typically relies on the nucleophilic displacement of a leaving group by an alkoxide (ie. Williamson ether synthesis). This work uses the reaction of relatively weak O-O peroxide bonds with carbanions for C-O bond formation in the synthesis of ethers. In the cyclic ether synthesis shown here, metal-heteroatom exchange is employed to create carbanions in situ. The rates and reactivity of various metalloids suitable for the generation of carbanions in the presence of peroxides will also be discussed.



## THEORETICAL STUDIES OF BINDING SITE HETEROGENEITY IN HIGH-PERFORMANCE AFFINITY CHROMATOGRAPHIC-BASED BIOINTERACTION STUDIES

Xiwei Zheng and David S. Hage, Department of Chemistry, University of Nebraska–Lincoln, NE 68508

This study used computer simulations to examine the effects of binding site heterogeneity in frontal analysis studies conducted by high-performance affinity chromatography. All methods were developed based on Microsoft Excel's statistical analysis software. It was first used to simulate experimental data with a set amount of random variations. Next, an approach was developed to examine the fit of simulated results to one- and two-site binding models at various levels of precision. The binding constants obtained by fitting the experimental data using this method with model systems corresponded with known binding constants, as obtained for data for the binding of gliclazide with glycated human serum albumin. This approach can also be used to determine the range of analyte concentrations that are needed to provide a given level of column saturation in two-site binding systems. A method was further built to determine the range and number of data points that are needed for frontal analysis studies of various systems. The results of this approach should prove to be a valuable tool in the study and prediction of interactions between drugs and proteins, especially in multi-site systems.

## DO RELATIVE ACTIVATION ENERGIES PREDICT REGIOSELECTIVITY OF NUCLEOPHILIC AROMATIC PHOTOSUBSTITUTION REACTIONS?

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When 2-chloro-4-nitroanisole (**1**) is irradiated ( $\lambda > 330 \text{ nm}$ ) at  $25^\circ\text{C}$  in aqueous solution with  $\text{NaOH}$ , three substitution photoproducts are formed: 2-methoxy-5-nitrophenol (**2**), 2-chloro-4-nitrophenol (**3**), and 3-chloro-4-methoxyphenol (**4**), in chemical yields of 69.2, 14.3, and 16.5%. The activation energies from the excited triplet state are: 1.831, 2.354, and 2.681 kcal/mol, respectively. The observed and Arrhenius calculated chemical yields at 0, 35, and  $70^\circ\text{C}$  are shown in the table below.

	<b>2</b> , $0^\circ\text{C}$	<b>3</b> , $0^\circ\text{C}$	<b>4</b> , $0^\circ\text{C}$	<b>2</b> , $35^\circ\text{C}$	<b>3</b> , $35^\circ\text{C}$	<b>4</b> , $35^\circ\text{C}$	<b>2</b> , $70^\circ\text{C}$	<b>3</b> , $70^\circ\text{C}$	<b>4</b> , $70^\circ\text{C}$
observed % yields	71.3	13.7	14.9	68.5	14.5	17.0	65.9	15.2	18.9
calculated % yields	71.4	13.6	14.9	68.4	14.6	17.1	65.8	15.3	18.9

The close agreement indicates that activation energy is an adequate predictor of regioselectivity. We cannot calculate the energies of the transition states accurately enough to make predictions by any quantum chemical methods. But we can calculate the relative energies of the triplet  $\sigma$ -complexes. The



failure of others to find the stable triplet  $\sigma$ -complex for the major product by density functional calculation is remedied by inclusion of the counterion, and by use of any other method of calculation.

## **GLYCOLATED ETHYNLARENES AS FLUORESCENT CHEMOSENSORS FOR THE DETECTION OF DIVALENT CATIONS**

Audrey T. Gallagher and James T. Fletcher, Department of Chemistry, Creighton University, Omaha, NE 68178

Dicarboxylated derivatives of 1,3-bis(*meta*-aminophenylethynyl)-5-phenylethynylbenzene and tricarboxylated derivatives of 1,3,5-tris(*meta*-aminophenylethynyl)benzene were recently shown to serve as effective chemosensors for the selective detection of divalent and trivalent analytes in an aqueous environment. Analyte binding was shown to cause a fluorescence decrease in solution, and such sensors were proposed to operate via a differential solubility mechanism wherein the sensor analogs precipitated to differing degrees depending on the combination of analyte and sensor identity. Individually, the carboxylated arenes did not exhibit a high selectivity towards specific metals, but with all six in tandem they can be used to differentiate between Al(III), Ba(II), Ca(II), Cd(II), Co(II), Cu(II), Mg(II), Ni(II), Pb(II), Ru(III), Sr(II), and Zn(II)). Because these sensors were expected to display interesting spectroscopic changes in solution upon analyte binding, attempts have now been made to increase the aqueous solubility of this class of di- and tri-carboxylated ethynylarenes by incorporation of a glycol chain to prevent their precipitation following analyte binding. Short chain ethylene glycol ethers of 2,4,6-triiodophenol were prepared by reaction with tosylated glycols in DMF with potassium carbonate. Sonogashira coupling was used to prepare diamino and triamino ethynylarene compounds that were then condensed with each of three cyclic anhydrides (succinic, glutaric and diglycolic anhydride), resulting in dicarboxylated and tricarboxylated ethynylarenes with glycol functionality. High-throughput fluorescence binding assays were repeated on this glycolated family of chemosensors, with the resulting fluorescence profiles compared to previously studied non-glycolated analogs to determine whether this approach was successful in improving the aqueous solubility for this chemosensor system. Details of the synthesis, characterization, fluorescence binding assays and impact on aqueous solubility will be presented.

## **DETECTION OF FOOD OIL ADULTERATION USING ATR-FTIR WITH CHEMOMETRIC STRATEGIES**

Grayson L. Jackson, Adam Zeiszler, Jiro Fujita, and David Dobberpuhl, Department of Chemistry, Creighton University, Omaha, NE 68178-0323

The food industry processes and sells oils extracted from the seeds and nuts of many different plants. Though the oils are chemically similar, they are valued differently based on factors such as taste, smoke point, processing cost and availability. These factors lead to large disparities in perceived quality and thus price. Recent scandals in which high-value oils were adulterated with low-cost oils indicate a critical need to quickly and unambiguously identify food oils. In this study, attenuated total reflectance Fourier-transform infrared spectroscopy (ATR-FTIR) was used to identify food oils from different sources. Ten commercially-available oils were studied using ATR-FTIR: almond, canola, corn, grapeseed, hazelnut, olive, sesame, soybean, sunflower, and walnut. As food oils are predominantly mixtures of triglycerides with different percentages of constituent fatty acids, subtle differences in FTIR spectra were exploited to identify the oils. Specifically, the average absorption in spectral regions 2995-3015  $\text{cm}^{-1}$ , 2915-2935  $\text{cm}^{-1}$ , 905-925  $\text{cm}^{-1}$ , and 955-975  $\text{cm}^{-1}$ , all corresponding to the degree of unsaturation among the constituent fatty acids, provided the most significant differentiation. Raw spectral data from these four regions were quantified utilizing various chemometric methods and resulted in a simple, non-destructive, and unambiguous strategy for identifying food oils.

## **CHROMATOGRAPHIC ANALYSIS OF THE BINDING OF GLIBENCLAMIDE TO GLYCATED HUMAN SERUM ALBUMIN**

Ryan E. Matsuda and David S. Hage, Department of Chemistry, University of Nebraska–Lincoln, NE 68588

Diabetes is a health condition that results in elevated levels of glucose in the blood stream caused by insulin deficiency or glucose intolerance. As a result, non-enzymatic glycation of serum proteins can occur. The purpose of this study was to use high-performance affinity chromatography to examine the binding of glibenclamide to human serum albumin (HSA) at various stages of glycation. Glibenclamide is a second generation sulfonylurea drug that is used to treat type II diabetes. This experiment used the method of frontal analysis to estimate both the number of binding sites and the association equilibrium constants for glibenclamide with HSA. The results show that glibenclamide interacted with HSA through a two-site model involving both high and low affinity sites. Zonal elution competition studies were also performed to investigate the effect of glycation on two specific binding sites, Sudlow sites I and II of HSA. An increase in affinity was seen for glibenclamide at both Sudlow sites I and II as the level of HSA glycation increased. These results were also compared to those of previous studies which have examined the binding of other sulfonylurea drugs to the same protein and binding regions.

#### **TRANSFORMATION OF PHARMACEUTICAL DRUGS IN THE PRESENCE OF WATER: EFFECT OF POLYMER ADDITIVES**

Jacob. A. Hettenbaugh and A.D. Gift, Department of Chemistry, University of Nebraska at Omaha, NE 68182-0109

Drug tablets contain active pharmaceutical ingredients (APIs) that can be present in various crystalline forms. Typically, the API in a drug tablet is present as an anhydrous crystal, however, it may go through an unwanted transformation to a hydrate crystal if exposed to water. Certain polymers have the capacity to inhibit this anhydrous-to-hydrate transformation of APIs, but the mechanism of inhibition is not well understood. In this study, various polymers were tested on the effectiveness of inhibiting the hydrate transformation of the API, carbamazepine. The anhydrous carbamazepine was combined with dilute aqueous solutions of the polymer and the hydrate transformation of the carbamazepine was monitored using an in-line Raman spectroscopy. Raman spectra were collected every 30 seconds. Multivariate software (SIMCA P<sup>+</sup>) was used to quantify the percent carbamazepine hydrate for each spectrum during the transformation process. The percent carbamazepine hydrate was then plotted with respect to the time to obtain a transformation profile. These transformation profiles were used to compare the inhibition of the various polymers tested. The various polymers examined included hydroxypropylmethylcellulose (HPMC), hydroxypropylmethylcellulose acetate succinate (HPMC-AS), polyvinylpyrrolidone (PVP), and polyvinyl alcohol (PVA). For each of these polymers, various properties were varied including degree of functional group substitution and differing chain lengths. Results showed that polymers with shorter chain lengths (lower molecular weights) were better at inhibiting the anhydrous-to-hydrate transformation of carbamazepine.

#### **A FLUORESCENT SENSOR BASED ON 1,8-NAPHTHALIMIDE FOR F<sup>-</sup> SENSING**

Chen Hou and Haishi Cao, Department of Chemistry, University of Nebraska at Kearney, NE 68845

Fluoride is an essential anion in nature and plays important roles in food processing, clinic analysis and fluorination of water supplies that make the quantitative analysis of fluoride to be highly demanded. Among current analysis techniques, fluorescent sensing, which translates molecular recognition into tangible fluorescence signal, has been considered as one of the most effective approaches for its high sensitivity, nondestructivity, and versatility. Over past years, numerous efforts have been devoted to develop fluorescent sensors on the basis of various signaling mechanisms for fluoride detection. However, the selectivity and sensitivity still are the major challenges for fluoride sensing. In this paper, we report the design and synthesis of a new N-imidazolyl-1,8-naphthalimide

based chemosensor with high affinity and sensitivity for fluoride detection.

### **TANDEM REACTIONS INVOLVING REDUCTIVE OZONOLYSIS**

Rachel Willand-Charnley, Shiva Kyasa Kumar, and Patrick H. Dussault, Department of Chemistry, University of Nebraska–Lincoln, Ne 68508

Whereas the cleavage of alkenes by ozone typically generates peroxide intermediates that must be decomposed in an accompanying step, ozonolysis in the presence of pyridine directly generates ketones or aldehydes through a process that neither consumes pyridine nor generates any detectable peroxides. The reaction is hypothesized to involve nucleophile-promoted dimerization of carbonyl oxides. The resulting zwitterionic peroxyacetals fragment to generate two carbonyl groups and a molecule of oxygen, while simultaneously regenerating the nucleophile. Using the knowledge gained from reductive ozonolysis in the presence of pyridine, successful tandem reactions were successfully performed.

### **SYNTHESIS, BIOLOGICAL EVALUATION, AND MOLECULAR DOCKING STUDIES OF NOVEL PHOSPHOINOSITIDE-3-KINASE (PI3K $\alpha$ ) INHIBITORS**

Dima A. Sabbah, Yuxiang Dong, Jonathan L. Vennerstrom, College of Pharmacy, University of Nebraska Medical Center, Omaha, NE 68198-6025; and Neka A. Simms and Michael G. Brattain, Eppler Cancer Institute, University of Nebraska Medical Center, Omaha, NE 68198-5950; and Edward L. Ezell, Eppler Cancer Institute, University of Nebraska Medical Center, Omaha, NE 68198-6805; and Haizhen Zhong, Department of Chemistry, University of Nebraska at Omaha, Omaha, NE 68182

The development of new PI3K $\alpha$  selective compounds is now the focus of intense research for anticancer therapy. We developed a novel series of PI3K $\alpha$  inhibitors. Satisfactory spectroscopic and elemental analysis data were obtained for the newly synthesized compounds. We evaluated the antiproliferative activity of these compounds in human colon cancer cells. Molecular docking of these compounds in PI3K $\alpha$  binding site reveals the structural basis of binding and the key binding residues. The output of this work might be helpful for anticancer drug design.

### **NMR-BASED METABOLOMICS STUDY OF THE METABOLISM OF STAPHYLOCOCCUS AUREUS INFLUENCED BY DIFFERENT ENVIRONMENTAL FACTORS**

Bo Zhang, Shulei Lei, and Robert Powers, Department of Chemistry, University of Nebraska–Lincoln, NE 68588-0304; and Nagender Ledala, Rosmarie Gaupp, and Greg A. Somerville, School of Veterinary Medicine and Biomedical Sciences, University of Nebraska–Lincoln, NE 68588-0905

In chemistry, Nuclear Magnetic Resonance (NMR) spectroscopy is a routinely-used instrument for molecular structure determination. Recently, NMR has become a powerful tool to study the collection of small molecules in a biological system, or the metabolome. A complete metabolomics protocol has been developed in our group based on NMR, which has been applied to many biological systems. Our NMR metabolomics methodology and important technical considerations will be discussed. Methicillin-resistant *S. aureus* (MSSA) is a pathogen that can lead to serious infections, and the regulation of almost all the virulence genes in staphylococci are mediated by environmental and nutritional factors. Therefore, a thorough understanding of metabolic pathways influenced by different environmental factors can be critical to uncovering regulation systems. In the presented talk, a series of environmental factors, including micro-aerobic growth, iron-depletion, and sub-inhibitory concentrated tetracycline addition, and the impact on the metabolome of MSSA will be discussed. Principle component analysis (PCA) and orthogonal partial least-squares discriminant analysis (OPLS-DA) were applied to show the relative relationship between metabolomes perturbed by various environmental factors. The PCA and

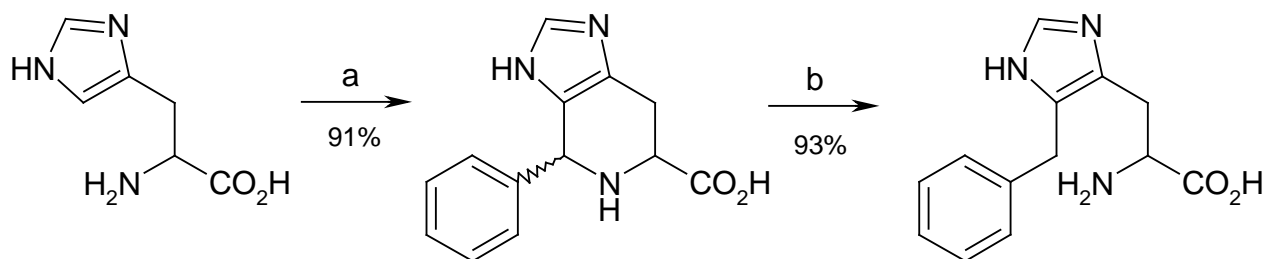
OPLS-DA analysis demonstrate that different ratios of medium-to-flask volumes can lead to a gradual change from aerobic to anaerobic bacterial growth. Iron as an essential nutrient; regulates the post exponential growth when the TCA cycle is activated. The overall goal of obtaining a detailed understanding of the influence of various environmental factors on MRSA is to discover effective therapies to treat infections caused by staphylococci bacteria.

This work is a contribution of the University of Nebraska Agricultural Research Division, supported in part by funds provided through the Hatch Act and from the National Institute of Health to GAS (AI087668) and the American Heart Association to RP (0860033Z).

### AN IMPROVED SYNTHESIS OF 4(5)-BENZYL-L-HISTIDINE

D. D. Smith, Department of Biomedical Sciences, Creighton University, Omaha, NE 68178-0405; and Audrey Gallagher, Wayne Gergens, Vincent Crowley, and Martin Hulce, Department of Chemistry, Creighton University, Omaha, NE 68178-0323; and Peter W. Abel, Department of Pharmacology, Creighton University, Omaha, NE 68178-0133

The serendipitous discovery that benzylation of the imidazole side chain of His<sup>10</sup> of the calcitonin gene-related peptide (CGRP) receptor antagonist CGRP(8-37) increases affinity and selectivity for human receptors led to the development of potent, human selective, CGRP antagonists N- $\alpha$ -Bn-(4(5)-BnHis)<sup>10</sup>-CGRP(8-37) (**1**) and N- $\alpha$ -Bzl-(4(5)-BnHis)<sup>10</sup>-CGRP(8-37) (**2**). Solid-phase synthesis of **1** and **2** employs benzylation of the assembled, resin-bound, protected peptide to introduce the benzyl group to the side chain of the histidyl residue. This step alone proceeds in a low 40% yield reducing the final yields of purified **1** and **2** to 6%. Our recent efforts to improve the yields of **1** and **2** have focused on the synthesis of the amino acid 4(5)-benzyl-L-histidine. A previously published, two-step preparation utilizes a Pictet-Spengler condensation under basic conditions between L-histidine and benzaldehyde to yield L-phenylspinacine as a mixture of diastereoisomers, which are subjected to hydrogenolysis to cleave a doubly benzylic carbon-nitrogen bond to yield 4(5)-benzyl-L-histidine (**Figure**). Attempts to reproduce this synthesis proved challenging with unreacted starting material present after each step and so we undertook a complete review of the synthesis. Our efforts revealed that increasing the number of equivalents of potassium hydroxide from two to three ensured completion of the Pictet-Spengler condensation in one hour. Furthermore, using catalytic transfer hydrogenation at elevated temperatures in the second step quantitatively cleaved the benzylic carbon-nitrogen bond in five minutes. Marfey's reagent was used to confirm that the chiral integrity of the  $\alpha$ -carbon remained intact. The utility of our optimized methods was explored in the synthesis of a series of new fluorinated 4(5)-benzyl-L-histidine derivatives.



Reagents and conditions: a, benzaldehyde, KOH, refluxing ethanol/water (1/2, v/v). b, ammonium formate, 10% Pd/C, refluxing methanol.

### EXOCYCLIC ALLENES BY LITHIUM ALUMINUM HYDRIDE REDUCTION OF 3-TRIMETHYLSILYLETHYNYL-2-CYCLOALKENONES

John M. Kum, Andrew K. Urick, and Martin Hulce, Department of Chemistry, Creighton University, Omaha, NE 68178-0323

Exocyclic allenes are relatively well-represented among allene-containing natural products. A subunit of the common carotenoid fucoxanthin, this structural motif has been exploited in syntheses of allene-containing carotenoids, terpenoids, and in preparation of analogues of prostacyclins and cephalosporins. Syntheses of this allene class typically rely on either extended conjugate additions to e.g. alk-2-en-4-ynones or syn  $S_N2'$ -like alkylations and reductions of alkynyl oxiranes. We report reaction of trimethylsilylethynyl cycloalkenones with 2 equiv of lithium aluminum hydride results in reduction of a vinylogously propargylic intermediate alcoholate to provide 3-(2-trimethylsilyl-ethenylidenyl)cycloalkanols in good yields. This provides a new method for exocyclic allene preparation.

## **MEASURING THE METHANOL CONCENTRATION IN BIODIESEL USING NEAR-INFRARED SPECTROSCOPY**

Kevin J. Kawa, B.A. Bialas, A.D. Gift, Department of Chemistry, University of Nebraska at Omaha, NE 68182-0109

Biodiesel is produced by reacting vegetable oil with methanol in the presence of a catalyst. The products of the reaction are methyl esters (biodiesel) and glycerol. However, there are also small amounts of unreacted methanol and vegetable oil present in the biodiesel after the reaction has come to completion. The biodiesel must be processed to remove the glycerol, methanol, and other possible contaminants. Regulations state that the methanol content in the biodiesel must be below 0.2% to be sold commercially. Testing the methanol content in biodiesel is typically done using gas chromatography, but this testing method can be time intensive and expensive. This project was to determine if Near-Infrared spectroscopy (NIR) could be used to quantify the methanol concentration in biodiesel. Biodiesel samples were supplied by our collaborator, Tighe Biodiesel, and these were used to create calibration samples with varying amounts of methanol. Spectra of these samples were collected on the NIR spectrometer. The NIR spectra were processed using a multivariate calibration program (SIMCA-P+) and a model was constructed which could be used to quantify the methanol concentration. A variety of models were developed by implementing different preprocessing methods and by analyzing different NIR spectral ranges. The results showed that the NIR spectrometer and calibration model could be used to quantitate the methanol content in the biodiesel with a prediction error of approximately 0.55%.

## **CHROMATOGRAPHIC APPROACH TO STUDY SULFONYLUREA DRUG BINDING TO HUMAN SERUM ALBUMIN IN DIABETES FOR PERSONALIZED MEDICINE**

Jeanethe A. Anguizola, K.S. Joseph, Ryan Matsuda and David S. Hage, Department of Chemistry, University of Nebraska–Lincoln, NE 68588

One specific aim of personalized medicine is to customize medical treatment based on the patient's needs while minimizing adverse drug reactions and side effects. The personalized medicine model holds a great promise for improving diagnosis and treatment of diseases such as cancer, Alzheimer's and diabetes mellitus. The number of diagnosed diabetic patients has increased 90% over the last two decades, making this disease a topic of world-wide concern. Diabetes is a well-known condition characterized by an abnormal high concentration of glucose in the blood due to a deficiency in insulin production and/or impaired efficiency in insulin action. Non reducing sugars such as glucose can react non-enzymatically with the free amino groups of proteins in a process called glycation. Some the complications of diabetes have been associated with the glycation of proteins such as collagen, lens crystalline, and hemoglobin. However, recent studies have indicated that glycation can also produce structural and functional modifications of carrier proteins such as human serum albumin (HSA). The purpose of this study was to use high performance affinity chromatography (HPAC) to examine the binding of four anti-diabetic agents, known as sulfonylureas drugs, to *in vivo* glycated HSA. This was performed by first isolating glycated HSA from the serum of two diabetic patients using an immunoaffinity anti-HSA resin, followed by immobilization of the resulting protein onto diol silica

through the Schiff base method. The clinical sample columns were then used in frontal analysis experiments to determine how the association equilibrium constants and binding capacities change for columns containing normal HSA and *in vitro* glycated HSA versus *in vivo* glycated HSA. Competition studies based on zonal elution experiments were performed to specifically examine the binding of these drugs to Sudlow sites I and II of HSA. The results of this work should provide important information that could be used to better understand these interactions and to eventually lead to the design of improved treatment regimes based on personalized medicine for patients with type II diabetes.

## **UNDERSTANDING METABOLISMS AND TOXICITIES OF TOP THERAPEUTIC DRUGS**

Victoria Mashinson, Mengyi Zha, and Haizhen Zhong, Department of Chemistry, University of Nebraska at Omaha, NE 68182, U.S.A.

Cytochrome P450 (CYP) constitutes an ubiquitous family of enzymes responsible for metabolizing drug molecules. There are quite a few CYP isoforms, each capable of converting drug compounds into different metabolites. Some programs have been proposed to predict the site of metabolisms (SOM). We investigate the common metabolisms of top therapeutic drugs in order to provide a guideline to minimize toxicities due to drug-drug interactions, which occur when two drugs share a metabolizing enzyme (CYP). We also evaluate the predictability of some programs developed for SOM prediction.

## **PREDICTION OF THE PKA OF SEVERAL CLASSES OF WEAK ACIDS FROM DFT STUDIES**

Paul A. Karr, Jake Childers, Jake Janak, and Nathan Gerdes, Department of Physical Science and Mathematics, Wayne State College, Wayne, NE 68787

The determination of the pKa of acids via experimental procedures can be very challenging. The experimental procedure involves obtaining pure samples and the proper determination of end points, which becomes more difficult for the weaker acids. A related problem is the determination of the protonation/deprotonation site for acids with multiple protonation sites. Recently, a procedure was devised in our laboratories to predict the pKa of protonated nitrogenous bases using HF methods and Cramer-Truhlar solvation schemes utilizing commercially available computational programs. We have extended this procedure to an analysis of acids by employing the B3LYP/6-31++G(d,p) model chemistry coupled with Tomasi's Polarized Continuum Model (PCM), the Polarizable Conductor Model (CPCM), and the Self-consistent Isodensity Polarized Continuum Model (SCIPCM) as implemented in the Gaussian 09 software suite in an attempt to determine the most efficient model chemistry/resource consumption ratio.

The selected acids and their conjugate bases were completely optimized to a stationary point on the Born-Oppenheimer surface. The difference in the computed energies of the acid and its conjugate base was graphed against experimental pKa in an effort to identify a trend in which computed dissociation energy closely correlates with experimental pKa.

## **IMPROVEMENT AND CATALYSIS OF METHANOL OXIDATION UTILIZING CERIA SUPPORTED PLATINUM**

Elizabeth Needels, D.L. Jackson, and C.L. Cheung, Department of Chemistry and Nebraska Center for Materials and Nanoscience, University of Nebraska–Lincoln, NE 68588-0304; and I. Gonzalo, L. Cunci, and C. Cabrera, Department of Chemistry and NASA-URC Center for Advanced Nanoscale Materials, University of Puerto Rico, San Juan, Puerto Rico 00936-8377

The electrocatalytic oxidation of methanol was improved by platinum (Pt) decorations on cerium oxide compared to bare cerium oxide coated at the electrodes. Three types of Pt clusters decorated ceria were compared: bulk ceria, nanoactive ceria, and ceria nanorods synthesized hydrothermally. The ceria substrates were each decorated with 20 at. % Pt versus Ce utilizing a co-precipitation method in solution

of ethanol and acetic acid. Electron microscopy techniques were used to characterize the morphology of the rods, while x-ray photoelectron spectroscopy, x-ray diffraction and x-ray absorption fine structure were used to determine the local environment of the platinum and cerium. Cyclic voltammetry was used to evaluate the effectiveness of each of the three different catalyst types for the oxidation of methanol in both acidic and basic solutions. The production of a higher current in the nanorods and nanoactive ceria versus the bulk ceria indicated that nanoscale substrates greatly increased the effectiveness of the catalysis of methanol oxidation. These results suggest that the Pt clusters decorated nanoscale ceria decorated electrodes has the potential to perform better in fuel cells than regular Pt electrodes.

## **INVESTIGATIONS INTO THE SYNTHESIS AND MECHANICAL PROPERTIES OF ANORGANIC BONE/POLYGLYCOLIDE COMPOSITES**

Lukasz Gauza, Chris Schwartz, Kris Hiebner and Jody Redepenning, Department of Chemistry, University of Nebraska-Lincoln, NE 68588-0304

Currently there is a demand for resorbable biomaterials that can be used for bone repair and reconstruction. Due to the conflicts overseas as well as civilian demographics associated with aging "baby boomers," these biomaterials have both military and civilian applications. We recently found that hydroxyapatite ( $\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$ ), which is the primary inorganic component of bone, can be used to initiate ring opening polymerization of cyclic lactones. In this presentation we report specifically on the surface-initiated polymerization of glycolide within the pores of anorganic bone, the inorganic structure that remains upon removal of potentially rejectable organic constituents. No additional solvent or catalyst is used. The resulting composites exhibit macroscopic morphologies and mechanical properties similar to that of the original bone. Polymerization conditions and material characterization including mechanical testing will be presented.

## **IDENTIFICATION AND ANALYSIS OF THE PRODUCTS REMOVED FROM HUMAN FEET BY AN ELECTROLYSIS FOOTBATH**

Erone Hankore and Charles Freidline, Division of Science & Mathematics, Union College, Lincoln NE 68506

The "electrolysis footbath" is advertised among alternative therapy healthcare providers as able to remove "toxins" from the body, including heavy metals. There does not seem to be much indication in literature that the reality of these claims has been tested with the identification of the metals or organic toxins, although there seems to be an ample supply of testimonials indicating improvement in the health of the patients. Using Atomic Absorption Spectroscopy to identify metals and Gas Chromatography-Mass Spectrometry, HPLC or LC-MS-MS, and gel electrophoresis to identify organic compounds, we will attempt to determine what is being removed from the bodies of individuals, both healthy and ones in need of treatment. We have already determined the mechanism does not directly involve electrolysis; the cell only generates an iron(III) hydroxide flocculent precipitate which comes in contact with the feet. Our current hypothesis is the iron(III) hydroxide is complexing in some way organic compounds from the feet. Upon acidifying with enough nitric acid to dissolve the iron(III) hydroxide, we assume that most organics will be released so we can extract with dichloromethane, and can also run the aqueous phase through HPLC.

## **CHEMISTRY AND PHYSICS PHYSICS**

### **ROSE ANALYSIS OF SHAPES**

Benjamin Knutson, University of Nebraska at Omaha, NE 68182

A metal detector is a device which responds to concealed metal. Most current metal detectors can infer the approximate size, density, and material composition of detected objects, but cannot discriminate against harmless objects such as metallic watches and jewelry, which must first be removed. It is our goal in this analysis to statistically compare the shapes of detected objects so that metal detectors can quickly and accurately infer the presence of concealed metal weaponry, thereby making them a more practical means of security. Though potentially useful in many areas, this shape analysis will be developed for further implementation of weapon detection systems in public buildings, specifically in schools.

Two shape equations are built from creating a helical mesh which wraps around the surface of each object. One shape equation denotes the coordinates of the surface points as distances from a central axis; the other as distances from the origin. A relation of shape equations (ROSE) compares the detected object's equations with those of other objects in a library to determine the relative amount of work it would take to transform the detected object into each member of the library. An Analysis of Variance test statistically compares the work values. The probability that the detected object is of the same class of objects as those in the library is given by the F-test.

The shape analysis will be performed on a test prism with respect to a library of prisms. The performance will measure the strength and efficiency of the analysis.

## **INDUCING MAGNETIZATION BY FLEXING GRAPHENE NANORIBBON**

Nabil Al-Aqtash, University of Nebraska at Omaha, NE 68182

Zigzag graphene nanoribbons (ZGNRs) are antiferromagnetic in the ground state with zero net magnetization due to the compensation of contributions from opposite edges. The uniform deformations (both shear and axial) do not produce magnetization due to the symmetry restrictions. However, we report the results of first-principles calculations that predict that the induction of net magnetization in the graphene nanoribbon upon non-uniform strain applied to the nanoribbon. Using density functional theory (DFT) method implemented in SIESTA code, we show that the bending or twisting of nanoribbon produces magnetization because in the presence of strain gradient the induced magnetization on opposite edges are not compensating each other. We estimate an average magnetization of  $\sim 3.3\mu\text{B}$  that produced from the bending of nanoribbon with the sinusoidal profile  $\delta x = A\sin(2\pi z/L)$  with  $A=3\text{\AA}$  and  $L=87.4\text{\AA}$  ( $z=0..L/2$ , i.e. the half of the period). Our study suggests that the induced magnetization can be used for the control of magnetic structure in graphene including the trap of the domain walls.

## **FLORESCENCE CORRELATION SPECTROSCOPY OF PROTEINS IN SUGAR SOLUTIONS**

Nathan Holman, Yuli Wang, Michael Nichols, and David Sidebottom, Department of Physics, Creighton University, Omaha NE 68178

Cryopreservation is a powerful technology with numerous applications in biological research and medical treatments. Often, simple sugars such as glucose or fructose are used as cryo-preserving agents for their ability to protect cells and proteins from damage due to crystallization of water at cryogenic temperatures. Despite widespread use as cryopreservation agents, the mechanism through which sugars protect biological samples is poorly understood. One possible mechanism, water replacement, predicts a measurable increase in the hydrodynamic radius with increasing sugar concentration. Using Fluorescence Correlation Spectroscopy (FCS) we have studied the diffusional dynamics using inherent tryptophan fluorescence in avidin coated polystyrene spheres. Development of a single photon FCS experiment using Green Fluorescent Protein (GFP) is ongoing to try and corroborate earlier results.

## **RECENT RESULTS FROM THE ALICE EXPERIMENT**

Bjorn S. Nilsen, Department of Physics, Creighton University, Omaha, NE 68178



In November 2010, ALICE measured its first Pb-Pb interactions at an energy of 2.76 TeV/nucleon. The highest energy and heaviest nucleus-nucleus interactions measured to date. Selected results from the analysis of this data, and possibly from the November 2011 run, will be presented. Comparisons to other measurements and possible implications with respect to our understanding of the Quark Gluon Plasma will be shown.

### **EFFECT OF NITROGEN DOPING ON THE ELECTRONIC AND OPTICAL PROPERTIES OF TAON**

F. Apostol, N. Al-Aqtash, Wai-Ning Mei, R. Sabirianov, Department of Physics, University of Nebraska at Omaha, NE 68182

TaON is considered as a potential candidate as a visible-light responsive photocatalyst. We report the results of *ab initio* studies of electronic structure of TaON in monoclinic and hypothetical cubic phases using VASP code. Specifically, we show that the position of conduction and valence band can be modified by varying the nitrogen (N) concentration in  $\text{TaO}_{1+x}\text{N}_{1-x}$ . The bandgap decreases monotonically with the increase of N concentration from near 2.7eV to just over 1.1eV (i.e. by 230%) when N concentration is reduced from  $x=0.5$  to 1.5. The bandgap reduction is mostly associated with the change in the position of the valence band, while the conduction band is not sensitive to nitrogen content. We calculated the optical absorption spectra and discuss the effect of nitrogen doping on the photocatalytic activity of oxinitrides.

### **DETECTION OF PHO MESONS IN ULTRA-PERIPHERAL HEAVY ION COLLISIONS**

James F. Ross, Department of Physics, Creighton University, Omaha, NE 68178

Particle production in large fields has been a topic of interest to heavy ion physicists since the early 1980's. this talk will briefly examine the mechanisms for such production and discuss how this phenomenon is studied in ultra-peripheral collisions at both the Large Hadron collider at CERN and the Relativistic Heavy Ion collider at Brookhaven national Laboratory. Particular attention will be given to the rho meson, the least massive spin-1 meson produced in these interactions.

## **EARTH SCIENCES**

### **INCORPORATING CLIMATE CHANGE INTO STATE DROUGHT PLANS**

Joseph P. Robine, D. J. Bathke, and M. J. Hayes, National Drought Mitigation Center, Lincoln, NE 68583

Droughts are natural hazards that should be considered a normal part of the climate that develop slowly over time. Droughts can be a costly hazard often times costing over one billion dollars. One way to help lessen the impacts of drought are to develop plans for how to respond. As the climate changes we expect to see droughts begin to last longer and become more severe. With the more severe droughts planning becomes even more important which is why states need to begin including climate change research into their state drought plans. Currently only four states include this information. The purpose of this paper is to show how states should incorporate strategies to deal with climate change in their drought plans.

### **A STUDY OF NITRATE LEVELS IN CHADRON CREEK, NEBRASKA, USA**

Abenezer Tadesse, Department of Physical and Life Sciences, Chadron State College, Chadron, NE 69337

Chadron Creek is located near Chadron in western Nebraska. The creek is an important public water source for the town and for those who live within its watershed. About 72% of the watershed is used for grazing, livestock, and wildlife. 14% of the watershed is used for farming; of which 3 % is

mainly used for alfalfa vegetation. In addition, the watershed contains at least 300 septic tank systems, which suggest that it is susceptible to nitrate contamination. Research shows that elevated levels of nitrate in drinking water pose a health threat. Thus, nitrate contamination is one of the main concerns of water quality in the United States. This study was conducted to assess nitrate levels in Chadron Creek, and to point out locations of possible sources of contamination. In November 2011, using a nitrate ion-selective electrode, nitrate levels of the creek were measured at 9 sample sites. Results were compared with land use data to assess human activity as a contributing factor towards nitrate pollution in the creek. Although land use patterns suggest that the creek is susceptible to pollution, the measured nitrate levels at all sites were less than 2ppm. Further study is being done to assess the effect of runoff events on the nitrate levels of the creek.

## **EFFECTS OF FIRE ON THE FERTILITY OF SOIL IN CHADRON NEBRASKA, USA**

Zachary J. Brown, Department of Physical and Life Sciences, Chadron State College, Chadron, NE 69337

A prescribed burn was conducted on October 23<sup>rd</sup>, 2011, on grassland five miles south of Chadron, Nebraska. The fire was approximately 7-8 acres in size. Bulk soil samples were taken at 0-3, 3-6, 6-9, and 9-12 inches below the surface at burned and unburned locations. The soil samples were taken at different depths to assess whether there was movement of nutrients in the soil profile. The elements tested were total carbon, nitrate nitrogen, phosphorus, calcium, magnesium, and potassium. The results of the analysis revealed little to no movement of nutrients in the soil profile. Previous studies have shown that during lower temperature burns total concentrations of all the main elements in the soil either remain constant or slightly decreased. There are few soil studies done on the grassland soils of the Pine Ridge, and in a region of such diverse topography it is essential that more studies of this type be done.

## **PROTECTION FROM ELECTROMAGNETIC RADIATION THROUGH CLAY SOIL USED AS CONSTRUCTION MATERIAL**

Ulrike J. Werner, Department of Math and Science, Oglala Lakota College, Kyle, SD 57752

This study examined the efficacy of the use of clay soils of the Pine Ridge Reservation in attenuating ambient anthropogenic electromagnetic radiation. Anthropogenic electromagnetic waves are one of the health hazards of modern lifestyles. Electromagnetic Fields hypersensitivity (EMF) or Idiopathic Environmental Intolerance attributed to electromagnetic fields (IEI-EMF) is a defined sickness (Marino & al, 2011). Clay is able to protect from unhealthy radiation. It can be used as protective matter in construction, where it has additional positive properties. Clay houses with 24 cm walls and greenroofs with 15 cm coverage resulted in a protective coverage of 22 dB = 99.4% for 1.8 and 1.9 GHz mobile phone network, and DECT wireless home phones. For directional radio waves around 4 GHz the protection is 60 dB = 99.9999 %. All around the world we can find clay buildings hundreds of years old, because it is a perfect construction material. It keeps the air moisture inside a building always at a level of 45% - 55%, the optimal situation for humans. Clay walls are able to bind poisonous particles like cigarette smoke. Temperatures are stored in the walls, which leads to coolness inside the building in summer and warmer temperatures in winter. Since the moisture inside the wall is kept at a level of 5% no extra lumber protection is needed. Insects need a moisture level of 14% and mold needs at least 20%. It is 100% recyclable. The way the use of electronic devices multiply, they may be the most violent, but invisible danger in the near future. This research was supported by the National Science Foundation Tribal Colleges and Universities Program at Oglala Lakota College (Jason Tinant and Hannan LaGarry, PIs).

## **SURFACE AND SUBSURFACE DISTRIBUTIONS OF URANIUM-BEARING STRATA IN NORTHWESTERN NEBRASKA AND SOUTHWESTERN SOUTH DAKOTA**

Historically, uranium was mined from open pits in Fall River and Harding counties, South Dakota. It is currently mined by in-situ leaching (ISL) in Dawes County, Nebraska, with an additional ISL facility proposed for Fall River County, South Dakota. Lithostratigraphic revisions have shown that devitrification of volcanic glass within the late Eocene Chamberlain Pass Formation (CPF - White River Group) from 38-40 Ma is the likely source of the uranium. It is concentrated within porous sandstones within the CPF, or where migration routes were available, in underlying Cretaceous sandstones. In our work we have adopted the conventions used by the University of Nebraska-Lincoln STATEMAP program in tracing the CPF in outcrops and in the subsurface. Outcrops of the CPF are herein recognized as the source of uranium contamination of soils, sediments, and surface waters near the communities of Whitney, Nebraska and Oglala, Calico, Pine Ridge, Rockyford, Red Shirt, Scenic, and Interior, South Dakota. Soil and sediment concentrations are currently being investigated at Oglala Lakota College (XRD, XRF, AA-MS, ICP-OES), although concentrations in surface waters near Pine Ridge in excess of 60 ppb have been reported (Botzum & others 2011). Subcrops of the CPF are herein recognized to be the source of uranium contamination of groundwater, often in excess of 20 ppb and as high as 40 ppb, near the communities of Pine Ridge, Wounded Knee, Manderson, Porcupine, Evergreen, Kyle, Potato Creek, and Wanblee, South Dakota (Botzum & others, 2011). Cretaceous sandstones are the likely source of groundwater contamination near Red Shirt. High levels of radon and arsenic have also been reported from local groundwater in these communities (see Salvatore & others 2010). This research was conducted with the assistance of the Oglala Sioux Tribe Natural Resources Regulation Agency supported by the NSF Tribal Colleges & Universities Program (Jason Tinant and Hannan LaGarry, PIs), an NSF South Dakota EPSCoR subaward to Oglala Lakota College (Gerry Giraud, PI), and an NIH Native American Research Centers for Health (University of Washington) grant to Elisha Yellow Thunder.

## **VERTEBRATE-TRACK HYPOTHESIS FOR THE ORIGIN OF ENIGMATIC SEDIMENTARY STRUCTURES WITHIN EOLIAN CROSS-STRATA OF THE NAVAJO SANDSTONE AT ZION NATIONAL PARK, UTAH**

David B. Loope, Vitaly A. Zlotnik, and Richard M. Kettler, Department of Earth and Atmospheric Sciences, University of Nebraska-Lincoln, NE 68588-0340

Unusual sedimentary structures consisting of numerous, linear arrangements of vertically oriented, cylindrical deformations (about 5-cm in diameter) are preserved in large-scale cross-strata within the Jurassic Navajo Sandstone at two sites in Zion National Park, southwestern Utah. The cylinders always are present as a series; they do not occur as individuals. As many as 20 individual cylinders (evenly spaced 5-10 cm apart) comprise each series. Individual cylinders within each series are fault-bounded, and extend vertically as much as 2 m. Laminae within cylinders are concave-up, and are displaced downward less than 1 cm below corresponding laminae at the perimeters of the cylinders. All cylinders begin and end within the same stratigraphic interval: most have their upper terminus just above a horizontal bounding surface. All cylinders terminate within the uppermost 2 m of a thick (underlying) set of large-scale cross-strata.

The evenly spaced circles of a series suggest a vertebrate trackway when they are viewed in plan on a single bedding plane. A few “normal” tracks (which penetrate and fold laminae only a few cm below the true tracking surface) are present within the cross-strata at both sites. We hypothesize that seasonally, zones of upward-seeping groundwater developed at the margins of interdune ponds. Tracking of animals across these zones led to the deep sediment deformation represented by the cylinders. Compaction of sands beneath each footfall would have locally raised pore-water pressure. This rise in pore pressure, when combined with the upward component of seepage, may have been sufficient to cause the rapid, upward flow of groundwater around each compacted, cylindrical mass. Laboratory-scale experiments to test this hypothesis are underway.

## **REVISED LITHOSTRATIGRAPHIC CORRELATION OF THE ARIKAREE GROUP FROM NORTHWESTERN NEBRASKA TO SOUTHWESTERN SOUTH DAKOTA**

Hannan E. LaGarry, Department of Math and Science, Oglala Lakota College, Kyle SD 57752; and Jonathan D. Marcot, Department of Animal Biology, University of Illinois at Urbana-Champaign, Urbana IL 61801; and David L. Fox, Department of Geology and Geophysics, University of Minnesota, Minneapolis MN 55455; and Curtis Belile and Helene Gaddie, Department of Math and Science, Oglala Lakota College, Kyle SD 57752

Based on detailed lithologic descriptions from the 2008-2011 field seasons, we revise and redescribe the lithostratigraphic correlation of the Arikaree Group from stratotypes in Sioux County, Nebraska to the Pine Ridge escarpment of southwestern South Dakota. We recognize the local Arikaree Group lithostratigraphic sequence mapped in northwestern Nebraska by the University of Nebraska STATEMAP program (1996-2006) consisting of (from bottom to top): Ash Creek beds (Oligocene), Monroe Creek Formation (Oligocene), Coffee Mill Butte beds (Oligocene), Harrison Formation (Oligocene-Miocene), Anderson Ranch Formation (Miocene), and Wounded Knee beds (Miocene). The section at Slim Buttes consists of the Monroe Creek and Harrison formations. The section at Grass Creek (north of Pine Ridge) consists of the Monroe Creek Formation and pedogenically modified Harrison and Anderson Ranch formations. The section at Manderson consists of the Monroe Creek and Harrison formations, and the pedogenically modified Anderson Ranch Formation. The section at Evergreen consists (in part) of the Monroe Creek Formation, the Coffee Mill Butte beds, the Harrison Formation, a newly recognized, mappable, olive green volcanoclastic sandstone, and the pedogenically modified Anderson Ranch Formation. We were not able to examine the higher cliffs at Evergreen for lack of safe access. The section at Porcupine/Porcupine Butte consists of the Monroe Creek Formation, pedogenically modified Harrison and Anderson Ranch formations, and the Wounded Knee beds. The olive green volcanoclastic sandstone at Evergreen is a newly recognized unit we have called the Oblaya Buttes beds. In all cases this sequence overlies the “brown siltstone beds” (= “lower” Sharps Formation) of the Brule Fm. (White River Group). This research was conducted with the assistance of the Oglala Sioux Tribe Natural Resources Regulation Agency (Michael Catches Enemy, Director) and was supported by the National Science Foundation Tribal Colleges and Universities Program at Oglala Lakota College (Jason Tinant and Hannan LaGarry, PIs).

## **NORTHWESTERN NEBRASKA LINEAMENTS CORRELATE TO FAULTS IN OUTCROP**

Jennifer A. Balmat and Michael B. Leite, Department of Physical and Life Sciences, Chadron State College, Chadron, NE 69337

The Spotted Tail range, a salient of the Pine Ridge escarpment near Chadron, NE, is an area of moderate to high fault density. Field evidence suggests that some lineaments identified on remotely sensed images are genetically connected to east-west oriented normal faults. Mapping identified a series of 5 major normal faults, all down to the south, with offset ranging from 2-50 m. A sixth and northernmost fault on the Spotted Tail range is a thrust fault. A reversal of dips occurs north of the thrust fault with beds dipping shallowly to the north. Most faults expressed in outcrop have not been traced beyond the east-west extent of Spotted Tail range. However, lineaments identified on remotely sensed imagery prior to field mapping extend well beyond the range. A total of 31 faults were mapped in a 20km<sup>2</sup> region in the Spotted tail Range. Fault and lineament azimuths were analyzed using a goodness of fit statistic and were found to be significantly similar. The mean distance from points on fault planes and their closest lineament and the mean distance from random points and their closest lineament were analyzed using the difference of two means statistic. The mean distance from fault points to lineaments was also found to be statically significant. The conclusion drawn from both the azimuth difference and the mean distance to lineament tests is that lineaments represent the subtle expression of faults in the Spotted Tail range and the Pine Ridge escarpment.

## **MAPPING FAULTS IN SOFT-ROCK ENVIRONMENTS; THE PINE RIDGE OF NORTHWESTERN NE**

Robert J. Boylan, Department of Physical and Life Sciences, Chadron State College, Chadron, NE 69337

The Pine Ridge in northwestern Nebraska is a dissected north-facing escarpment of Eocene through Miocene age rocks. There are few faults mapped, but recent studies of lineaments point to many more unmapped geologic structures. This study was inspired by the apparent association of gravel deposits with lineaments. Gravel deposits are probably correlated with the sediment from fault ruptures and drainage control in the Pine Ridge area. The studied deposit stands out because it is at the intersection of two flat bottomed, steep sided valleys. Flat bottomed, steep sided valleys have been recognized as features of fault controlled drainage. Closer examination showed a zone of extensive jointing and faulting of the Oligocene Sharps formation with low displacement listric faults and open joints. Joint attitudes were recorded at 4 sites in a 100 meter region of a fault-controlled canyon. Joints strike N 50 degrees E and dip 46 degrees SE. Another set 25 m away strikes S 18 degrees E and dips 47 degrees NE. The joints are highly systematic. The heavily jointed area is located at the intersection of the two valleys, which are offset with strike-slip displacement. Greater understanding of this area's structural geology can lead to advancements in economic practices of mining and groundwater flow; while additionally contributing to the understanding of the origin of the Pine Ridge.

## **A POSSIBLE SEISMIC SAND BLOW IN THE PINE RIDGE NEAR CHADRON, NE**

T. J. Stunkel, Department of Physical and Life Sciences, Chadron State College, Chadron, NE 69337

A circular depression in the Pine Ridge south of Chadron, NE, presents a case for a seismic origin. This feature has a diameter of about 40m, with raised rims on 3 sides, and depth from the higher north rim to the bottom fill of about 5 m. It lies on a south-facing slope with bedrock exposed on the uphill side. A clastic dike approximately 1 cm thick containing sandy sediments cuts the bedrock. The dike sediments are laminated parallel to the dike walls. Tree ring data from a mature Ponderosa pine growing in the bottom of the depression indicate that the tree germinated around 1880. The clastic dike, which establishes the maximum age, cuts late Miocene Arikareean Monroe Creek formation bedrock (ca. 23-25 Ma) but not the modern soil.

## **GROUNDWATER EXCHANGE ALONG FAULTS IN NORTHWESTERN NEBRASKA**

Adam D. Neumann, Department of Physical and Life Sciences, Chadron State College, Chadron, NE 69337

Faulting has been shown to have effects on movement of groundwater. This study measured chemical characteristics of groundwater south of Chadron, NE to determine if there was any mixing among shallow and deep aquifers. Water transfer along faults has implications for water supply and quality. Faults were identified using remote sensing, seismic data, and field observations. Water was sampled from 24 wells in a southeast to northwest transect across a fault and tested for alkalinity and conductivity using titrations and a solution analyzer. Preliminary data trends show increased alkalinity and conductivity levels along the fault compared with water from surrounding wells. This suggests possible aquifer mixing within the fault plane.

## **HISTORY/PHILOSOPHY OF SCIENCE**

## **DID DARWIN'S ORIGIN OF SPECIES HAVE A NEGATIVE IMPACT ON NATURAL THEOLOGY?**

Claire M. Oswald, Department of Biology, College of Saint Mary, Omaha

There continues to be an opinion that the publication of Darwin's *Origin of Species* in 1859, destroyed natural theology. Historically, *natural theology* has served as an umbrella term for wide variety of arguments. Scientists, theologians, and clergy alike employed the insights of natural theology to advance the defense of theism against the claims of those that do not believe. The arguments of natural theology have ranged from purely rationalistic "ontological" arguments that the very meaning of the concept of God as a perfect Being implies the existence of such a Being and ideas from design.

## TEACHING OF SCIENCE AND MATH

### USING AN INQUIRY APPROACH TO TEACHING THE SCIENTIFIC METHOD

Phyllis M. Higley, Department of Biology, College of Saint Mary, Omaha, NE 68106

In an effort to focus on observational skills and to create a genuine research atmosphere, I am developing an inquiry-based approach to teaching the scientific method. An activity focused on water ecology was presented in three parts to introductory cellular biology students. In part I students worked in groups to compare protozoan life found in pond and creek water and submitted results and discussion reports, including graphic presentations of the data and concluding statements. In part II students were asked to design and conduct an experiment to determine whether the grass cuttings in hay infusions were a source of nutrients or protozoa. Students, working in groups, collected data and presented reports that followed research paper format including title, introduction, methods, results and discussion, and references. Part III involved an in-class discussion of previous research findings and data presentation. Students then individually rewrote the reports to show their improved understanding of scientific reporting. Evaluation of the activity indicated that the students would benefit from a more extensive introduction to protozoa and strategies for organizing their databases. Because the students are learning new skills, the inquiry question must be very simple with limited experimental variables. This would facilitate time management, data summary, and the ability to relate results to the study question. However, students made gains in several areas. They improved their microscopy skills, became familiar with protozoans, and developed rudimentary data presentation and scientific writing skills. Furthermore, the students gained an appreciation of the microscopic life found in natural water sources, and the challenges of doing science.

### DESIGN AND IMPLEMENTATION OF INQUIRY-BASED RESEARCH PROJECTS TIED TO WRITTEN RESEARCH REVIEWS IN AN UNDERGRADUATE PHYSIOLOGY COURSE

Tessa L. Durham Brooks, Department of Biology, Doane College, Crete, NE 68333

The laboratory portion of Bio 356, Human Physiology, has previously utilized the iWorx data acquisition system and associated labs as a major portion of its curriculum. While this approach can be useful for applying key concepts, the step-wise nature of the protocols has not been effective in promoting student inquiry. For the last two years, the laboratory was redesigned to encourage the natural interest students have in human processes and to ease the anxiety that can come with learning new technology. The project consists of literature exploration and a written literature review, design of an experiment related to the literature that integrates the functions of at least two body systems, analysis of the resulting data using simple statistics, and presentation of research projects in a seminar-style format. Teams complete their projects over the course of 10 – 12 weeks. Three of these weeks include additional preparatory lessons in data acquisition and analysis. Inquiry projects span topics ranging from the impact of loneliness on cardiovascular function to the effects of cooling and compression on muscle performance. Projects utilize a range of methodologies, including the iWorx apparatus. Students have been more confident in using the iWorx equipment and more motivated to complete their laboratory work using this approach. In addition, students gain the extra benefit of tying their projects in to current physiological research.

### COMPUTER SIMULATIONS IN COLLEGE TEACHING

Abbi Placzek, C. Helmink and J. Kren, BryanLGH College of Health Sciences  
Lincoln, NE 68506-1398

The use of computer simulation in teaching is an inexpensive and powerful tool in providing students with a better understanding of cause-effect relationships. Development of computer models enhances students learning by providing a hands-on experience with simulating clinical situations they face within the health care settings on daily basis. Applying the scientific method of modeling and simulation to physiological processes of the human body greatly enhanced our analytical thinking and group problem solving skills. We will be presenting an example of the effect of Cardizem and Amiodarone on function of the cardiovascular system.

#### UTILIZING COMPUTER MODELING IN NURSING EDUCATION

Emilie Heitmann, K. Fox, S. Christ and J. Kren, BryanLGH College of Health Sciences  
Lincoln, NE 68506-1398

Teaching computer simulations in nursing curriculum is a relatively new approach in nursing education not seen at many colleges. We utilized computer simulation to develop a model on infectious disease spread among hospital patients. The purpose of this exercise was to use critical thinking in evaluating clinical settings and visualizing the risk of patients developing infection. Critical thinking, an essential skill in nursing education and practice, helps students solve challenging problems they will face in the nursing profession.

#### MODELING PATHOLOGY OF PULMONARY SYSTEM

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Computer simulation and modeling can address some of the important phenomena in body homeostasis that are relatively simple to model, without the knowledge of complex mathematics. Some examples include cardiovascular, pulmonary and renal functions and spread of infectious diseases. Project-based learning in a technology-rich environment for collegiate students is quickly becoming a popular teaching tool. We have developed a computer model simulating normal function of the pulmonary system. We compare and analyze the normal function with pathological conditions as pulmonary embolus, pulmonary hypertension and diabetes mellitus.

#### TEACHING MICROBIOLOGY LAB AS A RESEARCH BASED EXPERIENCE.

Ann Buchmann, Department of Physical and Life Sciences, Chadron State College, Chadron, Ne  
69337

Microbiology labs are often taught as a set of cookbook exercises, designed to teach sterile technique, the identification of microbes using selective and differential agars, and the measurement of bacterial growth. The laboratory experience, however, can be used to teach other skills: critical thinking, inquiry, collaboration, and the processes of reading primary literature and writing a scientific paper. Over the past 1.5 years, I have redesigned the Microbiology laboratory to more resemble the scientific process. For two semesters, students isolated and identified extremophile bacteria from nearby alkaline lakes; while in the present semester students have isolated bacteria from their own bodies to determine the range of antibiotic resistances in common, human-associated bacteria. Students have isolated and studied the bacteria, purified DNA to be sent for sequencing, and used databases to identify bacteria. Students learn how to critically interpret data and how to work together as a group to prepare and write reports. During the course of the semester, students also read scientific papers, using these papers as a template to write about their own scientific experiments. By the end of the semester, students developed their own hypotheses and designed experiments to test their hypotheses.

## LIVE BAT ENCOUNTER K-5 SCHOOL PRESENTATION

Melanie O'Brien, Parent/Volunteer, Lake Maloney Elementary, 858 E. Correction Line Road, North Platte, NE 69101

NAS funded a "Live Bat Encounter" presentation by the director of the Organization of Bat Conservation in Michigan for two elementary schools in North Platte, NE. The presentation will be discussed along with the school's partnership with the local children's museum and their subsequent additional presentations reaching over 300 more people.

## COLLEGIATE ACADEMY BIOLOGY SESSION A

### ETHANOL AS A SECOND HIT FOR LIVER INJURY INDUCTION IN ETHANOL-FED HCV NS5A+ TRANSGENIC MICE

Jace D. Heiden, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504-2794; and J. Wagoner, R. Simpson, N. Osná, Liver Study Unit, The Omaha Veterans Affairs Medical Center, the Department of Internal Medicine, University of Nebraska Medical Center, Omaha, NE 68105; and L. Poluektova, Center for Neurovirology and Neurodegenerative Disorders, Departments of Pharmacology and Experimental Neurosciences, Pathology/Microbiology and Internal Medicine, University of Nebraska Medical Center, Omaha, NE 68198

The Hepatitis C virus (HCV) virion structure includes a structural core protein and a nonstructural NS5A protein. These proteins are well-characterized inducers of oxidative stress and are normally degraded by the proteasome. The proteasome is a large intracellular proteolytic enzyme that degrades ubiquitinated and oxidatively modified host and viral proteins. Oxidative stress induced by HCV proteins can be potentiated by ethanol and disrupt proteasome activity. While the effects of HCV core protein synergism with ethanol have been characterized in previous studies, it remains unclear how NS5A protein affects proteasome activity. Here, it is shown that high fat and ethanol diets potentiate liver damage and lipid accumulation when NS5A protein is present. Proteasome activity was suppressed by ethanol feeding, leading to increases in oxidative stress levels that induced substantial liver damage.

### INTERACTION BETWEEN CagZ AND THE GLOBULAR DOMAIN OF Cag5 IN THE PROCESS OF CagA TRANSLOCATION

Benjamin M. Wiese and G.A. Duncan, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504-2794; and D.A. Bonsor, Institute of Human Virology, University of Maryland—Baltimore, MD 21201

The gram-negative bacterium *Helicobacter pylori* has been intensively studied, including its connection to various gastroduodenal diseases. In the most severe cases, *H. pylori* has resulted in gastric adenocarcinoma. These cases have been linked to the group of *cag* (cytotoxin-associated gene) encoded proteins associated with *H. pylori*, and research has identified CagA in particular. This protein has been subject to much research and is well understood, which has led to the first steps in understanding the *cag* specific type IV secretion system (T4SS) necessary for translocation of CagA. However, the steps required before CagA enters the T4SS, particularly the *cag* specific T4SS, is not well understood. Two proteins known to be present prior to the T4SS and required for translocation of CagA are Cag5 and CagZ. We will clone and express the globular domain of Cag5, which to our knowledge has not been previously done, and will test for interaction with CagZ. Interaction between the entire protein Cag5 and CagZ has been shown, but the role and functionality of this interaction is not fully understood at this



time. This study will provide a deeper level of understanding of the interaction between these proteins and provide insight into the necessity of Cag5-CagZ interaction.

#### AN IN VITRO TRANSWELL SYSTEM SIMULATING THE PULMONARY MUCOSAL EPITHELIUM

Paul Williams and Therese McGinn, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504-2794

The epithelium provides the body's first line of defense as a physical barrier to external hazards. When the immune threat is airborne, the pulmonary mucosal lining plays a critical role in the body's complex sequence of responses. The extent and exact processes involved are not yet defined and leave a large gap in the understanding of the interactions between the virus and the mucosal epithelium. This lack of understanding hinders the development of treatments and preventative measures when addressing the issue of exposure to common viruses. To better study these interactions a model of this system must be developed. Our main objective with this section of the research was the generation and confirmation of a consistent in vitro representation of the pulmonary mucosal epithelium using a Transwell system. The integrity of the epithelial barrier is evaluated by measuring transepithelial electric resistance (TEER) using a Volt-Ohm meter. Initial attempts at barrier formation yielded insufficient TEER values, but adjustment of the air-liquid interface facilitated increases in resistance which were consistent with intact epithelial function. Optimization of methods will continue in efforts to establish a confluent sheet of epithelium demonstrating tight junctions. This publication was made possible by Grant Number P20GM103427 from the National Institute for General Medical Science (NIGMS), a component of the National Institutes of Health (NIH) and its contents are the sole responsibility of the authors and do not necessarily represent the official views of NIGMS or NIH.

#### ACTIVATION AND MATURATION MARKER EXPRESSION IN KG-1 DENDRITIC-LIKE CELLS

Stacey L. Coufal, P.T. Williams, and T. McGinn, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504-2794

Mature dendritic cells (DCs) alert the immune system to pathogenic invaders and provide the link between innate and acquired immune responses. Once activated, DCs migrate through mucosal tissues in order to present antigen to B- and T-cells. Through antigen presentation, DCs induce the proliferation and activation of antigen-specific B- and T-lymphocytes. Mature DCs capable of this function can be identified by their branch-like appearance; however, little is known about the specific proteins that are expressed on the surface of mature DCs. The purpose of this study was to characterize and optimize techniques to detect maturation markers and activation status of cultured KG-1 dendritic-like cells. In this study, we show that immunophenotyping and flow cytometry can be used to determine the percentage of DCs expressing surface proteins such as CD11c and CD83, which have been identified in previous literature as activation markers. Establishing clear parameters for observation of KG-1 cell activation will enable us to further our understanding of innate immune signaling in vitro. This publication was made possible by Grant Number P20GM103427 from the National Institute for General Medical Science (NIGMS), a component of the National Institutes of Health (NIH) and its contents are the sole responsibility of the authors and do not necessarily represent the official views of NIGMS or NIH.

#### STANDARDIZATION OF MULTIPLEX REAL-TIME RT-PCR ASSAY FOR CONCURRENT BVDV-BRSV INFECTION

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Bovine viral diarrhea virus (BVDV) and bovine respiratory syncytial virus (BRSV) cause significant economic loss in cattle production worldwide. It is therefore essential to develop fast, efficient, consistent, and inexpensive diagnostic techniques that allow early and accurate detection so the animals can be treated and not spread the disease. This study focused on standardizing a multiplex real-time RT-PCR assay to simultaneously amplify and detect BVDV and BRSV from a single sample. The machine was standardized by making serial ten-fold dilutions of known viral titer cell lysates and was validated by re-examining cell lysates from a previous study that were taken at subsequent time intervals post-infection. The assay proved effective but improved efficiency will require additional adjustments before it can be called a diagnostic standard.

#### METHYLATION STATUS OF N-CADHERIN PROMOTER SEQUENCE IN HUMAN BREAST CANCER CELL LINES: IMPLICATIONS FOR MOTILITY AND INVASIVENESS

Sarah Pracht, Nick Lukens and K.E. Marley, Department of Biology, Doane College, Crete, NE 68333

Cadherins are a family of transmembrane glycoproteins that provide cell-cell adhesion. E-Cadherin has been found to be a tumor-suppressor gene, whereas N-Cadherin has been found to promote motility and invasiveness of certain cancerous tissues, regardless of E-Cadherin expression. DNA methylation is the covalent attachment of methyl groups to regions of DNA rich in CG sequences. It has been shown that DNA methylation on the promoter region of a gene correlates with down-regulation of that gene. We show here that BT-20 human breast cancer cells are found to be methylated at the N-Cadherin gene promoter sequence. Methylation of tumor-suppressor genes has been linked with development of cancerous growth. Demethylating agents have been approved for the treatment of MDS, a disease that easily progresses into acute myeloid leukemia. Clinical trials examining the effect of demethylating agents on solid tumors have begun, hoping to demethylate tumor-suppressor genes. However, the N-Cadherin promoter region is often methylated in solid human cancers, a finding further supported by our own methylation data. Demethylating agents could demethylate the N-Cadherin gene, potentially increasing motility and invasiveness within these tissues. This lab has established that BT-20 cells are methylated at the N-Cadherin promoter region. We are now exploring the effects of demethylation treatments on the motility and invasiveness of the BT-20 breast cancer line.

#### EVALUATION OF N-CADHERIN PROTEIN EXPRESSION AFTER TREATMENT OF BT-20 HUMAN BREAST CANCER CELLS WITH METHYLATION INHIBITORS

Maire Rose Donnelly, M. Hruska, N. Lukens, S. Pracht and K.E. Marley, Department of Biology, Doane College, Crete, NE 68333

Cell adhesion plays a major role in constructing a functioning organism from an accumulation of its parts. Cadherins are a class of  $\text{Ca}^{2+}$  dependent transmembrane adhesion proteins found in a variety of different tissue types. There are several types of cadherins, each fulfilling needs specific to the tissue of which they are a part. Inappropriate expression of N-cadherin in a line of human breast cancer cells known as BT-20, which normally produce E-cadherin, may enable the cells to acquire unusual and dangerous characteristics. Previous research has determined that the N-cadherin promoter region is methylated in BT-20 cells. The presence of methyl groups on the promoter blocks the binding of transcription factors and thereby prevents expression of N-cadherin. Methylation inhibitors have been approved for treatment of some non-solid tumors but have not been effective against solid tumors. In light of the ineffectiveness of methylation inhibitors against solid-tumors, it is hypothesized that if BT-20 cells are treated with a methylation inhibitors, the N-cadherin promoter of the daughter cells will become unmethylated, allowing N-cadherin to be expressed. It is also hypothesized that the demethylated cells will become motile and invasive. Data presented here will be exploring whether treatment of BT-20 cells with methylation inhibitors including azacytidine and decitabine result in demethylation and subsequent expression of N-cadherin protein using Western analysis.

## RECOVERY, PURIFICATION AND LABELING OF INLB AS A POTENTIAL DRUG DELIVERY AGENT

Trent Ahlers, Gustavo Zardeneta, Doug Christensen and Shawn Percy, Department of Physical and Life Sciences, Wayne State College, Wayne, NE 68787

*Listeria monocytogenes* is a pathogenic Gram-positive bacteria that can invade human cells through the use of several surface proteins. These proteins act as ligands to receptors on the host cell trigger uptake of the bacteria by the human host cells. One of these bacterial surface proteins is InlB which has potential to be utilized as a means of delivering helpful drugs to human cells. An InlB containing plasmid has previously been cloned into *E. coli* allowing for production of the protein of interest. Current work involves purification and visualization of InlB as well as its conjugation with a fluorescent tag to aid in monitoring its potential internalization via HeLa cells. This publication was made possible by Grant Number P20GM103427 from the National Institute for General Medical Science (NIGMS), a component of the National Institutes of Health (NIH) and its contents are the sole responsibility of the authors and do not necessarily represent the official views of NIGMS or NIH.

## EFFECTS OF AMPRENAVIR ON EXPRESSION OF EPSTEIN – BARR VIRUS PROTEIN

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Patients taking Highly Active AntiRetroviral Treatment (HAART) medication, who are infected with Epstein - Barr virus, have been developing Non-Hodgkin's lymphoma at a heightened rate. One possible reason for the increased rate is the interaction of the HAART medication with Latent Membrane Protein 1 (LMP1) that cells infected with the Epstein – Barr virus create. Previous research has shown that not all exposure to protease inhibitors (PI) in HAART results in an increase in LMP1 expression. Amprenavir was the only PI examined to do so. To test this connection, IB4 and SAV3 cells were grown with incremental exposure to Amprenavir for various lengths of time. Results indicate a direct relationship between exposure and expression. This research supported by Grant Number P20GM103427 from the National Institute for General Medical Science (NIGMS). Amprenavir (#8148) was made available through the NIH AIDS Research and Reference Reagent Program.

## ANTIBIOTIC RESISTANCE SCREENING VIA PCR IN/AROUND FEEDLOTS

Mitch Knudsen and Doug Christensen, Department of Life Sciences, Wayne State College, Wayne, NE 68787

Antibiotics are commonly administered subtherapeutically for growth promotion and disease prevention in cattle. This area of antibiotic use has raised concerns as to what impact it will have on the intestinal flora of cattle and the population of antibiotic resistant bacteria in the environment. To screen for antibiotic resistant bacteria in and around several feedlots in northeast Nebraska, PCR reactions were performed on 19 culture samples to test for tetracycline (K and M), virginiamycin, erythromycin, methicillin and amoxicillin resistance genes. Genes for resistance against tetracycline K, virginiamycin, erythromycin, methicillin and amoxicillin were found in no culture samples. The tetracycline resistance gene TETM was found in 100% of culture samples. Upon identification of the TETM resistance gene in all samples, antibiotic susceptibility testing was performed to confirm the presence of bacteria actively utilizing the tetracycline M resistance gene. The outcome of these results will be detailed. This publication was made possible by Grant Number P20GM103427 from the National Institute for General Medical Science (NIGMS), a component of the National Institutes of Health (NIH) and its contents are the sole responsibility of the authors and do not necessarily represent the official views of NIGMS or NIH.

## THE IMPACT OF THE “HURDLE EFFECT” ON ANTIBIOTIC RESISTANCE

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Bacterial cells contain spontaneous mutations within their genome. These mutations can be a hindrance for the organism's survival, or as seen with antibiotic resistance, they may positively affect the cell in a given environment. Bacterial cells lacking a necessary mutant gene for resistance will succumb to the antibiotic when present while those that by chance, possess genes that code for resistance proteins will flourish and reproduce. Antibiotics were used individually at concentrations in which antibiotic resistance was achieved within bacterial cells. Subsequently, the concentrations of both antibiotics were combined in order to determine the frequency of naturally occurring resistance toward multiple antibiotics, compared with the frequency in which bacterial populations possess genes for only single antibiotic resistance. If the frequency of resistance in bacterial populations subjected to multiple antibiotics is determined to be significantly lower than the frequency of resistance harbored in bacterial genes against a single antibiotic, there may be advantageous rationale to treat bacterial infections with multiple antibiotics, suppressing the selective pressure toward singular antibiotic resistance. This publication was made possible by Grant Number P20GM103427 from the National Institute for General Medical Science (NIGMS), a component of the National Institutes of Health (NIH) and its contents are the sole responsibility of the authors and do not necessarily represent the official views of NIGMS or NIH.

## CHARACTERIZATION OF ANTIBIOTIC RESISTANT BACTERIA FROM THE PLATTE RIVER

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The biological and chemical composition of water is influenced not only by natural factors, but also by human activities. Since Nebraska is a rural state, pollution from agricultural processes plays a major role in surface water quality. Farming communities frequently use antibiotics to help stave off disease and infection. This overuse and misuse of antibiotics is allowing naturally occurring antibiotic-resistant bacteria to become more prevalent. The U.S. Center for Disease Control and Prevention considers antibiotic resistance to be one of its top concerns. This study is in the initial stages of searching for correlations between the presence of antibiotic-resistant microorganisms and different sources of environmental contaminants in our water supply.

Initially, water samples were collected from the Platte River. Microorganisms cultured from these samples were selectively isolated for antibiotic resistance by being exposed to Ampicillin. These antibiotic-resistant isolates have been subjected to various microbiological techniques to identify common structural, metabolic and genetic characteristics. Kirby-Bauer antibiotic testing has been done to identify isolates that are resistant to more than one antibiotic. Detection and location of the resistance gene in each isolate will be determined using DNA testing.

## MICROBIAL COMMUNITIES IN RAINWATER HARVESTING SYSTEMS

Mallory L. Iseminger, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504-2794; and M. Pels, S. Bae, and M. J. Kirisits, Environmental Science Institute, University of Texas-Austin, University Station, TX 78712

As traditional freshwater sources continue to be depleted, the need for alternative water sources increases. Rainwater harvesting systems attempt to meet this need by providing water for potable and non-potable uses. Since raw rainwater might not be safe for direct potable use, common treatment methods include filtration and ultraviolet light or chlorine for disinfection. Various biological contaminants are present in raw rainwater and can include potential pathogens. Very few data regarding the efficacy of common rainwater treatment methods exist, so the purpose of this study was to compare the bacterial communities in harvested rainwater before and after treatment. The rainwater samples were collected from a galvanized metal roof in Central Texas where filtration and ultraviolet disinfection

are used. DNA was extracted from the water followed by polymerase chain reaction (PCR) to amplify the 16S rRNA gene. The PCR product was cloned and sequenced, and the microorganisms are currently being identified through BLAST (Basic Local Alignment Search Tool). Soil related microorganisms such as *Aciobacteria* sp., *Nitrosprira* sp., and uncultured *Sphingobacteria* sp. were identified in the untreated rainwater sample. If suspected pathogens are identified in any sample, it will raise awareness that harvested rainwater must be carefully treated. Knowledge of the types of bacteria in harvested rainwater will provide information that will lead to the most appropriate treatment methods.

#### TLR-3 EXPRESSION AND ACTIVATION OF NF $\kappa$ B, AND BRADFORD PROTEIN ASSAY WITH HUMAN BRONCHIAL EPITHELIAL CELLS

Sean D. Pauley, Betsy Barent, Therese McGinn, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504-2794

Pulmonary mucosal epithelial cells work as an initial barrier to air-borne pathogens in the respiratory system. By utilizing cultured human bronchial epithelial cells (16HBE) in vitro, we sought to better understand innate immune response signaling pathways within the respiratory tract. Toll-like receptor 3 (TLR-3), the pattern recognition receptor that initiates the innate antiviral response, was stimulated by incubation with the synthetic ligand, Poly I:C. Upon ligation of TLR-3, the transcription factor NF- $\kappa$ B is translocated into the nucleus. Experiments described here show that after one hour stimulation with PolyI:C, NF- $\kappa$ B can be detected within the nuclear fraction by Western blot assays. In an effort to improve the reproducibility of the Western blot results, we employed the following approach: 1) utilize the Bradford protein assay to quantify the relationship between cell number and total protein concentration of 16HBE cellular lysates; 2) standardize the concentration of protein to be investigated by Western blot assays for detection and localization of NF- $\kappa$ B. With a better understanding of innate immune mechanisms of the airways, we may be able to modulate the immune response to improve antiviral treatments and to control unwanted inflammation of the respiratory mucosa. This publication was made possible by Grant Number P20GM103427 from the National Institute for General Medical Science (NIGMS), a component of the National Institutes of Health (NIH) and its contents are the sole responsibility of the authors and do not necessarily represent the official views of NIGMS or NIH.

#### EVALUATION OF EXPRESSION OF PUTATIVE N-CADHERIN REGULATING TRANSCRIPTION FACTORS IN VARIOUS CELL LINES

Michaela Hruska, M.R. Donnelly and K.E. Marley, Department of Biology, Doane College, Crete, NE 68333

Cadherins are transmembrane proteins that have an important role in cell adhesion during early stages of morphogenesis and development, and are important in maintaining normal tissue architecture. N-cadherin is a type of cadherin found in neurons, fibroblast, and mesenchymal cells allowing these cells to interact with other N-cadherin expressing cells. Studies have shown that N-cadherin gene expression is associated with cancer cell metastasis, migration, invasion, and likely influences motility. In previous research from our laboratory PCR was used to clone fragments of the N-cadherin promoter between -462 bp and -1876 bp to identify possible binding sites for transcription factors. A luciferase assay identified two fragments of interest that significantly expressed or repressed luciferase expression. The Transcription Element Sequence Search (TESS) database predicted several putative transcription factor binding sites in these fragments. Western analysis is being used to explore which transcription factors are expressed in various N-cadherin expressing cell lines.

#### PRODUCING A METABOLIC FINGERPRINT FOR ARABIDOPSIS THALIANA PARENTAL LINES USING PROTON NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY

Autumn M. Longo and Tessa Durham Brooks, Department of Biology, Doane College Crete, NE 68333

An approach to produce a metabolic fingerprint from plant tissue extracts using <sup>1</sup>HNMR spectroscopy is being developed. The production of a metabolic fingerprint will be used to characterize changes in the chemical makeup of the root during a gravitropic response. It has previously been shown that the ionotropic glutamate receptor glr 3.3 functions during the root gravitropic response. Therefore, since amino acids activate this receptor it is feasible that they will be among those metabolites that change between metabolic fingerprints. With this knowledge two goals arise: 1. Are there changes in metabolic fingerprints during root gravitropism, specifically are there changes in amino acid composition? and 2. What genes are involved in mediating this change in the metabolome during the response? Recombinant inbred lines (RILs) will be used as a source of genetic variation. To validate the use of RILs for identifying genetic loci that contribute to changes in the metabolic fingerprint, the parental lines must show significant differences in their metabolic fingerprints over the course of the root gravitropic response. Through this project, the feasibility of the development of a high throughput method to identify phenotypes will be explored. This will help link gene sequence to functions in metabolic pathways.

#### LINKING MORPHOLOGY TO DIET IN THE PHYLLOSTOMINE BATS

Rachel V. Gibson, Erin E. Stukenholtz, and H.A. York, Department of Biology, Doane College, Crete, Nebraska 68333

The Neotropical leaf-nosed bats (family Phyllostomidae) are regarded as the most ecologically diverse mammalian family, due in large part to the wide range of dietary habits they exhibit. Subfamily Phyllostominae offers an excellent representation of this diversity, as it includes frugivorous, nectarivorous, insectivorous, and carnivorous species, many of which are omnivorous to a significant degree. Nonetheless, detailed information about dietary breadth is lacking for many species. Within the family, morphometrics of the skull are important indicators of diet, whereas the morphology of the ears and noseleaf are closely tied to foraging mode. However, several deviations between morphology and dietary behavior are known among the leaf-nosed bats. In this preliminary study, we explore the relationships among cranial, ear, and noseleaf morphometrics and known diet for several species of phyllostomines in an attempt to reveal patterns and exceptions that will aid in continued work aiming to elucidate the foraging ecology of this subfamily of bats.

#### EFFECTS OF LEAD ON PLANT GROWTH AND EVIDENCE OF TRANSLOCATION

Carolyn Behney, P. Higley, B. Mauck, J. Keyte, J. Chang, J. Karr, College of Saint Mary, Omaha NE 68106-2377

Studies have shown that some plants are capable of incorporating lead during growth. Ingestion of plants grown in an environment containing lead is a concern for individuals because cognitive impairment has occurred in children with blood lead concentration less than 10 µg / dL. This study focuses on the extent and effects of lead uptake by plants. Measurements were taken on filter paper-, soil-, and hydroponically-grown edible plants; pea (*Pisum sativum*) and radish (*Raphanus sativu*). Two plants known to phytoaccumulate lead, Morning Glory (*Ipomoes purpurea*) and sunflower (*Helianthus annus*), are included for comparison. Plants grown on filter paper in 100 ppm of lead displayed root and stem abnormalities as well as necrosis as compared to healthy control plants. The study will further explore plant root malformation and investigate uptake and translocation concentrations of lead in stem and leaf tissue.

#### DISTRIBUTIONAL RECORDS OF LARGE BRANCHIOPOD SHRIMP (CRUSTACEA: BRANCHIOPODA) IN THE NEBRASKA SANDHILLS WITH NOTES ON HABITAT PREFERENCE

William E. Mausbach and Barbara Hayford, Department of Life Sciences, Wayne State College, Wayne, NE 68787

Large branchiopods live in habitats ranging from ephemeral pools to permanent lakes. The Nebraska Sandhills is a large region (19,600 sq. mi) in central and western Nebraska characterized by chemically diverse lotic habitats ranging from ephemeral road side ditches and ponds to permanent lakes. The diversity of lotic environments in the Sandhills is likely to support diverse groups of large branchiopods, but despite surveys in the 1950s and 60s, little is known about large branchiopods from the Sandhills region. To increase the known biodiversity and distributions of large branchiopods in the Nebraska Sandhills, 39 lotic sites were sampled in April and May 2011, from both wildlife refuges and roadside ditches in Cherry, Sheridan, Garden, Holt, and Morrill counties. Nineteen of the 39 sites sampled contained large branchiopods increasing the distributional records of five species: *Lynceus brachyurus*, *Lepidurus* sp., *Branchinecta potassa*, *Eubrachipus bundyi*, and *Eubrachipus ornatus*. *B. potassa* is endemic to the Nebraskan Sandhills and very little information about type locality and habitat preference is known. Elevation, latitude, longitude, total dissolved solids (TDS), pH, and salinity were measured or recorded at each site; and results indicate that high concentrations of TDS and high percent salinity are the best predictors of whether *B. potassa* will be present at a site in the Nebraska Sandhills.

#### PATHWAY ENRICHMENT OF CO-LETHAL NETWORKS

Kelsey Augustin and Kathryn Dempsey, Departments of Computer Technology, Information Systems, and Life Sciences, Wayne State College, Wayne, NE 68787; and Hesham Ali, College of Information Science and Technology, University of Nebraska at Omaha, NE 68198

The utilization of biological networks to model and integrate different types of biological data continues to grow. Particularly, the systems biology approach is taking center stage in many bioinformatics applications. Among the various types of biological networks, co-lethal interaction networks are unique networks that model protein pairs whose removal from a cell is fatal. Enriching co-lethal networks by integrating pathway information and knowledge about co-lethality, in addition to relevant biological functions, can help in improving targeting and manipulation techniques. Specifically, the identification of relationships among genes and gene products from the enriched co-lethal networks can lead to the discovery of new ways to automate the detection of disease and therapy targets. Although several recent studies have attempted to explore co-lethal networks, the identification of properties in these networks is understudied, leaving much of their information still untapped. In this project, co-lethal networks in yeast cells are constructed and enriched by currently available pathway information. Graph theoretic approaches are then used to analyze the structures of the networks and identify key overlapping relationships among its elements. This work exposes biological properties associated uniquely with co-lethality, as well as revealing characterizing structures of the *Saccharomyces cerevisiae* co-lethal network, which in turn may lead to the discovery of new pathway information. This publication was made possible by Grant Number P20GM103427 from the National Institute for General Medical Science (NIGMS), a component of the National Institutes of Health (NIH) and its contents are the sole responsibility of the authors and do not necessarily represent the official views of NIGMS or NIH.

#### GENOTYPIC AND PHENOTYPIC CHARACTERIZATION OF *ULMUS PUMILA* (SIBERIAN ELM), *U. RUBRA* (RED ELM), AND THEIR HYBRIDS

Brandon J. Schlautman, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504-2794; and Juan E. Zalapa, USDA, Agricultural Research Service, Vegetable Crops Research Unit, Department of Horticulture; and Johanne Brunet, USDA, Agricultural Research Service, Vegetable Crops Research Unit, Department of Entomology, WI 53706

*Ulmus pumila* (Siberian Elm), a noxious weed and invasive species, is resistant to Dutch Elm Disease and has largely replaced the North American elms which have been exterminated by the disease.

The species is known to hybridize with *Ulmus rubra* (Red Elm), a tree native to mesic forests of the Midwestern and Eastern United States, and hybridization has increased the genetic diversity of *U. pumila* possibly facilitating its evolution of invasiveness. In order to create an effective Red Elm genetic conservation strategy and to eradicate *U. pumila* and its hybrids, it is necessary to have an accurate set of morphological traits which can be used to distinguish between the species. In this study, we phenotypically identified 91 individuals of mixed *U. pumila*, *U. rubra*, and their hybrids using 25 morphological traits, and the same 91 individuals were identified genotypically using species-specific microsatellite alleles. Through comparisons of the phenotypic and genotypic identification, we found that though no single morphological trait can accurately distinguish the species and their hybrids; however, using a combination of multiple traits including leaf size and shape, bud pubescence, and floral anatomy, species and hybrids can be accurately identified. Continued studies could assist in increasing our understanding of hybridization and introgression between cultivated woody species and their wild relatives, and may further our ability to predict the fate and genotypic and phenotypic characterization of future North American elm populations.

#### IDENTIFICATION OF THE QUORUM SENSING GENE IN MYCOBACTERIUM SMEGMATIS VIA TRANSPOSON MUTAGENESIS

Bri Dahlgren, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504-2794

Quorum sensing (QS) is a density-dependent bacterial communication system that regulates gene expression. It controls microbiological functions of medical, agricultural and industrial importance (Zhang, 2004). Some of these microbiological functions are symbiotic in the agricultural industry (Westenberg, 2008), food spoilage and biofilm formation in the food industry (Bai, 2011) and bacterial pathogenesis in the medical field (Xavier, 2005; Zhang, 2004). It also plays a role in virulence, sporulation, conjugation and bioluminescence (Kaprelyants, 1996). In this study transposon mutagenesis is used in an attempt to randomly disrupt genes found in *Mycobacterium smegmatis* in order to discover the gene(s) involved in its quorum sensing communication system. Mutants of *M. smegmatis* are obtained and tested against *Streptomyces* to see if the two bacteria communicate with one another. *Streptomyces* was chosen because it has a well-known QS system and produces pigmentation and aerial hyphae as a response to QS. With further efforts, once the gene that codes for QS is discovered the molecule(s) involved can be discovered and both the gene and molecule(s) can have their DNA sequenced. In return, the results found for *M. smegmatis* can possibly be applied to how QS may function in the *Mycobacterium* species that causes Tuberculosis, therefore having significant importance for human health. Due to the lack of growth of mutant colonies and lack of PCR confirming that the mutant colonies are *M. smegmatis* there have been no significant results made.

#### EVALUATION OF BIOFORGE AS AN APPLIED SEED TREATMENT TO PIONEER 93M11 SOYBEANS IN WAVERLY, NE

Kim Topil, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504-2794

BioForge ST, a nitrogen and potash anti-oxidant containing growth enhancer, was applied as a seed treatment to Pioneer 93M11 soybeans. This treatment proposes, to reduce plant stressors and maintain the overall health of the plant thus increasing yield. The purpose of this experiment was to determine if the seed treatment BioForge ST, would increase soybean yield in comparison to the untreated Pioneer 93M11 soybeans. Data was collected on the various plant physiological parameters throughout the growing season. These data, included emergence population, heights, main-stem trifoliolate nodes, height:main-stem node ratio, chlorophyll content, nodule counts and mass, and yield at harvest. Although BioForge ST, had showed increased yield in application to other crops, upon Excel T-test analysis, no significant statistical difference was found between soybeans treated with BioForge ST, and those that were untreated.



## THE EFFECT OF TRICLOSAN ON THE PROLIFERATION OF PERITONEAL TISSUE EXPLANTS IN CORRELATION WITH POST-SURGICAL WOUND HEALING

Megan M. Puckett, Department of Biology, Hastings College, Hastings, NE 68901

As a result of the high frequency of post-surgical infection, antibacterial coated suture material has been developed and is suggested to reduce infection during healing. Triclosan is a common antibacterial that is now being incorporated into suture material. When the sutures are placed in the body, the triclosan is slowly released to the tissue over time. Triclosan at levels lower than the concentrations found in sutures has been shown to have slight toxic effects on tissue explants, meaning it may affect tissue healing when sutures are used. Recent studies show a potential for accumulation in fatty body tissues which would amplify the exposure to triclosan. Since exposure time to the drug plays a significant role in the magnitude of its results, the effects on tissue cultures should be investigated more thoroughly. The purpose of this study was to determine if triclosan inhibits tissue proliferation at supraphysiological doses to find out whether or not further study is required. It was hypothesized that triclosan would have a significantly negative effect on tissue proliferation. However, the results showed that even at high doses, triclosan had no effect on proliferation.

## GAPDH GENE ISOLATION, EXTRACTION AND SEQUENCING OF OENOTHERA MACROCARPA

Ashley M. Chalupa, Department of Biology, Chadron State College, Chadron, NE 69337

Glyceraldehyde-3-phosphate dehydrogenase (GAPDH) is a gene found in almost all living organisms although the sequence of the gene varies between species. GAPDH is one of many housekeeping genes expressed in all tissue types at varying levels playing a key role in glycolysis. This gene has also been linked to increased apoptosis, but the pathways utilized by the gene are unknown. Specific sequences are being used to further the understanding of how GAPDH protein functions. The specific GAPDH sequence in *Oenothera macrocarpa* (evening-primrose) has not been previously described and was the goal of this research. The genomic DNA was extracted from the leaves and cotyledons; the gene was amplified before inserting into *E. coli* cells. Plasmid DNA was harvested from bacteria purified. The plasmids were sent for sequencing at an exterior lab; results were added to GenBank for future use in finding the exact function of the GAPDH gene. Further sequences of the GAPDH gene in evening-primrose are needed to become a common sequence. The sequence will then be available for use in other research.

## COLLEGIATE ACADEMY BIOLOGY SESSION B

## ANALYSIS OF THE CRYSTALLIZATION OF MANNITOL AND THE SUBSEQUENT EFFECTS ON THE HUMAN BODY

Kailin K. Bellows, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504-2794

Mannitol is a sugar alcohol that is widely used in the food industry as a bulking agent or sugar substitute, in pharmaceutical products because it does not react with active components in drugs, and also as a diuretic agent, specifically during cardiovascular surgery. One potentially problematic characteristic of Mannitol is that it easily crystallizes and cannot be administered intravenously in the crystallized form. If crystals reach the blood stream, it is speculated that they will induce neurological complications. The purpose of this research is to determine if heating is an effective method for getting rid of the crystals, but if crystals are still present, if the filters in the heart and lung pump used during such an operation are an effective secondary method to prevent crystals from reaching the patient's blood stream. Bottles of Mannitol containing crystals visible to the naked eye were submerged in a 51°C

water bath until crystals were no longer visible. The minimum and maximum time required for the crystals to be dissolved was 30 and 90 minutes, respectively. A drop from the dissolved bottle was then viewed under a microscope and crystals were seen on the slide. To determine if the surrounding pH affected the formation of crystals, a heart and lung pump was primed with either Plasmalyte (pH=7.4) or saline (pH=5.0). Bottles of Mannitol, either straight from the manufacturer containing no visible crystals or bottles in which the crystals had been physically dissolved, were then added the pump and allowed to cycle. To determine if the filters at various locations in the pump were effective at catching the crystals, samples were taken from the filters and viewed under a microscope. All samples from the filters contained crystals. Thus, it is highly probable that the crystals are making it to the blood stream of the patient so the current preparation methods and heart and lung pump filters are not effective.

#### THE INDICATIONS OF THE VIDEO SWALLOW STUDY IN NEUROLOGICALLY NORMAL CHILDREN

Hannah Kinberg, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504-2794

Aspiration is the entry of foreign matter or secretions into the lungs. Penetration is a similar event in which foreign matter coats the larynx but is immediately cleared. On a chronic scale, both can result in serious complications. Barium video swallow studies (VSS) have proven useful in diagnosing aspiration and penetration "from above." Because VSS is commonly used in diagnosis, knowledge considering its implications and predictability is useful. A retrospective chart study was performed involving 52 pediatric patients seen at Children's Hospital and Medical Center and University of Nebraska Medical Center. Chi-square analysis was used to discover relationships between subsequent VSS's, chest x-ray results and age of diagnosis. Chi-square revealed no significant difference between age of diagnosis and consistencies aspirated or penetrated, nor was significance noted in the comparison of the number of patients who aspirated/penetrated in subsequent VSS's. No significant difference was noted between successive chest x-rays. A chi-square between the age of diagnosis and the results of initial chest x-rays also proved to be nonsignificant. While the study found no statistical significance, there was a trend, and a more powerful statistical analysis and more data may reveal significance.

#### EFFICIENCY OF RECREATIONAL WATER PURIFIERS ON CYANOTOXIN AND COLIFORM BACTERIA REMOVAL FROM SALT CREEK AND OAK LAKE OF LINCOLN, NEBRASKA

Matthew Anderson and Jerald Bricker, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504-2794

Water must be pure to ensure health to the public. Many methods work to purify water including membrane filtration and Ultraviolet light (UV) purification but their dependability and the public's trust in these products are not fully known. The efficiency of four different brands of portable water purification units tested consisted of three membrane filters (MSR Sweetwater Filter Cartridge, Katadyn Hiker Microfilter Water Filter, and the First Need XL Water Purifier) and one UV purifier (SteriPen Classic Purifier). These purifiers were assessed by several non-experienced students for their ease of assembly, ease of use, comfort level in apparatus, and trust that the purifier is performing efficiently. The UV purifier was found to be the easiest of the purifiers to assemble and one of the most comfortable purifiers to use but was found to have less trust in the UV water purifier's purifying abilities. These purifiers were also tested for their efficiency on two bodies of water (Salt Creek and Oak Lake) that exhibit numerous coliform bacteria. Efficiency was assessed by measuring coliform bacteria and levels of these waters before and after purification. Cyanotoxins (Anatoxin and BMAA) were inoculated into water samples and then measured before and after purification by the purifiers. Results indicated that the traditional membrane filtration units performed more efficiently than the ultraviolet light purification unit (SteriPen) in removing coliform bacteria and cyanotoxins. Some differences occurred between the different brands of traditional membrane filters.

## LOCOMOTOR PERFORMANCE FITNESS ADVANTAGE OF KLEPTOGENETIC MOLE SALAMANDERS (GENUS AMBYSTOMA)

Garrett M. Janzen, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504-2760

Kleptogenetic mole salamanders (genus *Ambystoma*) have persisted sympatrically with sexual populations for millions of years, longer than any other unisexual population. We hypothesized that kleptogenesis offers fitness advantages through enhanced locomotor performance. Kleptogens (hybrids with genome combinations LTT, LTTi, LTTT, and LTTTi) and sexual individuals (*A. jeffersonianum*, *A. laterale*, and *A. barbouri*) were tested for endurance on a custom-built treadmill. Sexual individuals were also tested for maximum speed, stride length, and stride frequency. Tests failed to show significantly greater endurance in unisexual salamanders than in sexual salamanders. The three sexual groups were tested for maximum speed, stride length, and stride frequency on a meter-long track. *A. barbouri* was found to exhibit a greater stride frequency than the other species, but no species held an advantage in maximum speed or stride length. Though our results did not suggest locomotor performance advantages in kleptogens, we maintain that kleptogenesis may yet offer some form of fitness advantage.

## THE EXTRACTION OF BIOACTIVE COMPOUNDS FROM POTENTIAL FUNGAL ENDOPHYTES

Lucas Hemmer, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504

Endophytes are either fungi or bacteria that inhabit plant tissues in a symbiotic relationship that aids both species. These organisms have potential to produce novel compounds to be used as antifungal and antibiotic drugs. One such endophyte, labeled Bearnes4F1L01B, from a prior experiment proved to be promising in its primary bioassay of producing bioactive compounds that inhibit bacterial growth. Several extraction procedures were utilized until it was found that compounds produced by Bearnes4F1L01B grown on PDB media were successfully extracted with ethyl acetate. Several duplications and secondary bioassays demonstrated zones of inhibition with several various bacteria that indicate the presence of multiple bioactive compounds. Later HPLC tests of the successful extracts could reveal novel molecules that have antibacterial potential.

## BIOASSAYS OF FUNGAL ENDOPHYTES ISOLATED FROM BROMELIAD HOST PLANTS GROWING IN A NORTH-CENTRAL ECUADOR CLOUD FOREST

Capri Juilfs, Jerry Bricker, and Karis Overton, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504-2794

During the summer of 2010, 35 host plants of the Bromeliaceae (pineapple family) were collected in the cloud forest at the Yanayacu Research Station in north-central Ecuador. Two hundred forty-two endophytic organisms (fungi and bacteria) were isolated from the plant host tissue and established in pure culture. In an effort to establish antibacterial or anti-fungal properties of the endophytes (and potential use as antibiotics in human medicine), bioassays were completed by testing the sensitivity of the following organisms: *Bacillus subtilis* and *Escherichia coli* (Gram negative test bacteria), *Pseudomonas fluorescens* and *Staphylococcus epidermidis* (Gram positive test bacteria), *Candida albicans* and *Mycobacterium smegmatis* (test fungus and test mycobacterium, respectively). There were 44 fungal organisms that showed positive results with 17 showing highly positive results.

## IDENTIFICATION OF BROMELIAD ENDOPHYTES FROM AN ECUADOR CLOUD FOREST USING ITS 1 AND 2

Rebeca Chavez Herrera, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504

Fungal endophytes were collected from cloud forest bromeliad leaves at the Yanayacu Biological Station in northeastern Ecuador in 2010 as part of a five-year project to identify medicinally important metabolites. This portion of the project focused on the molecular identification of the endophytic organisms. The DNA was extracted from the samples using the Qiagen Dneasy Plant Mini Kit. The internal transcribed spacers of the ribosomal subunit (ITS 1 and 2) were amplified by PCR using universal fungal primers designed by White et al. (1990). The PCR product was visualized using 1.5% agarose gels stained with ethidium bromide. After verifying successful PCR amplification, the samples were cleaned with either the Sigma GenElute PCR Clean-Up Kit or Diffinity RapidTips. The samples were sequenced at the UNMC High-Throughput DNA Sequencing and Genotyping Core Facility. Finally, the sequenced DNA was confirmed by comparing the forward and reverse sequences in MEGA 5.0, and run through the BLAST feature of NCBI's GenBank identify the organism or its closest match in the database.

#### LOSS OF ANTI-PREDATOR BEHAVIOR IN EASTERN FOX SQUIRRELS (*SCIURUS NIGER*) AFTER ISOLATION

Allison Connealy Neville; Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504-2794

Costly anti-predator behaviors may be lost in prey animals after isolation from a former predator. In such a case, the reintroduction of the formerly extirpated predator may have devastating effects on prey populations. To test the potential loss of anti-predator behavior in naïve prey in Nebraska, fox squirrels were presented with urines from two predators that were previously native to the area, urine of a familiar predator, and urine from a non-predator. The results did not show any evidence of behavior loss, but these results may have been due to a small sample size. Further research is needed in order to gain information pertinent to conservation efforts that may have unforeseen effects resulting from reintroduction of top predators to the area.

#### EVALUATION OF AQUAPORIN-3 EXPRESSION IN SALT, FRESH, AND BRACKISH WATER-ACCLIMATED SAILFIN MOLLIES (*POECILIA LATIPINNA*)

Jaclyn R. Lange, G.W. Gerald, and T.M. McGinn, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504-2794

Aquaporins (AQP) are integral membrane proteins that have been identified in every major organismal group and are vital for the acquisition of water and maintaining osmotic balance within cells and tissues. The following study was conducted to determine plasticity in AQP-3 expression in the gills of a euryhaline fish, the sailfin molly (*Poecilia latipinna*) in three different salinities. We hypothesized that there would be increased amounts of aquaporins following long-term exposure to increases in salinity. Individuals were acclimated to full marine, brackish, and fresh water tanks for six weeks. Immediately following acclimation, gills were removed and used to acquire epithelial proteins. Reverse Transcription Polymerase Reaction (RT-PCR) was used for analysis of the AQP-3 expression levels. Results concerning differences in AQP-3 expression among the different salinity-acclimated individuals will be presented.

#### DEVELOPMENT OF A SYSTEM TO DEplete Sir2 IN ORDER TO STUDY ITS ROLE IN MAINTAINING SILENT CHROMATIN AT THE RIBOSOMAL DNA LOCUS IN *SACCHAROMYCES CEREVISIAE*

Lindsey E. Jones, Department of Biology, Nebraska Wesleyan University, Lincoln, NE 68504-2794; and Rachel Jordan, Interdisciplinary Graduate Program of Genetics; and Mary Bryk, Department of Biochemistry and Biophysics, Texas A&M University, College Station, TX 77843

The ribosomal DNA (rDNA) locus in the budding yeast *Saccharomyces cerevisiae* is a tandem array of 150-200 copies of the ribosomal RNA genes. The highly repeated rDNA locus acquires a silent chromatin conformation that protects the integrity of the rDNA locus, and the yeast genome. Silent chromatin represses RNA Pol II transcription and homologous recombination, which is detected using yeast strains that have a single HIS3 reporter gene integrated into the rDNA locus. Previous experiments have shown that the level of Pol II transcription and recombination is unequal across the rDNA array. The goal of this research was to develop a system to deplete the silencing protein Sir2, which associates with the rDNA, from yeast cells in order to determine if Sir2 protein regulates the level of Pol II transcription and recombination at different positions across the rDNA array. Two approaches of depleting Sir2 protein were pursued. First, the SIR2 gene was deleted from three yeast strains that each have a HIS3 reporter gene at a different position within the rDNA array. Mapping analysis revealed that the position of the HIS3 gene had moved in each of the *sir2*Δ mutants, which prevented the analysis of the effect of loss of Sir2 protein on position-dependent gene expression. The second approach required placing the SIR2 gene under the control of a tetracycline-sensitive repressible promoter so that Sir2 can be depleted from the cell rapidly in the presence of doxycycline, a tetracycline analog. The Sir2 depletion experiment was inconclusive.

#### COLLEGIATE ACADEMY CHEMISTRY AND PHYSICS

#### PARTICLE IDENTIFICATION FOR PHI MESON PHOTOPRODUCTION IN ULTRAPERIPHERAL COLLISIONS AT RHIC

Barak R. Gruber and Janet Seger, Department of Physics, Creighton University, Omaha, NE 68178

The high energy research group at Creighton University works at RHIC (the Relativistic Heavy Ion Collider) as a member of the STAR (Solenoidal Tracker At RHIC) collaboration. We analyze data collected from ultraperipheral collisions of gold nuclei accelerated to approximately the speed of light. In ultraperipheral collisions, the nuclei do not physically overlap, but interact electromagnetically. In this talk, we will focus on the observation of the phi meson through its decay channel into a  $K^+$  and  $K^-$ . We will discuss the techniques used to identify the daughter Kaons, the reconstruction of the phi invariant mass as well as the preliminary results of this analysis.

#### PARTICLE IDENTIFICATION FOR ELECTRON-POSITRON PAIRS IN ULTRAPERIPHERAL COLLISIONS AT RHIC

Jarrod K. Bang and J. Seger, Department of Physics, Creighton University, Omaha, NE 68178

At RHIC (Relativistic Heavy Ion Collider), two atomic nuclei are stripped of their surrounding electrons and accelerated to near the speed of light. Creighton is a member of the STAR (Solenoidal Tracker At RHIC) collaboration that studies ultraperipheral collisions through the STAR detector. Ultraperipheral collisions occur when two nuclei miss but pass each other at a very short distance yet still interact with one another electromagnetically. While the nuclei continue along the beam line, particles are produced from the interaction. The electric fields in these interactions are very intense. Studying electron-positron pairs can aid in understanding the quantum electrodynamics in these intense fields. This talk will introduce the use of different particle identification methods used for electron-positron pairs produced during such interactions.

#### OPTIMAL EXERCISE MODES FOR INDIVIDUALS WITH DIABETES

Cole Marolf, Department of Physics, Nebraska Wesleyan University, Lincoln NE 68504; and  
Judith Burnfield, Madonna Research Institute, Lincoln, NE 68506

This project will determine the safest form of exercise for individuals with diabetes and resulting complications of the foot. Forces involved in various exercise modes (walking, elliptical machine, treadmill, recline stationary bicycle, stair machine) will be predicted. Then, using data collected at the Madonna Research Institute using these exercise modes, impact forces will be analyzed. From these data and the predicted forces, a recommendation will be formed concerning which exercise mode is safest and most beneficial to the diabetic patient.

#### MODIFYING JAVA SIMULATIONS OF BERNOULLI'S PRINCIPLE TO SIMULATE WIND TUNNEL AIR FLOW THROUGH A VENTURI

James Duin, department of Physics, Hastings College, Hastings, NE 68901

Bernoulli's principle relates pressure, flow speed, gravitational acceleration and potential energy for fluid flow along a streamline. Modifications were made to a Java simulation animating particle flow in a two dimensional tapered pipe. The program was used to visualize Bernoulli's principle and was modified to approximate air flow in a wind tunnel. Pressure and velocity profiles were measured in two Venturi sections; one with streamline flow and one with backflow regions. A comparison between the experimental data and pressure and velocity histograms generated by the program was completed. The program was then modified to calculate particle positions in three dimensions and to display flow streamlines.

#### RECONSTRUCTION EFFICIENCIES FOR THE RHO AND J/PSI MESONS IN ULTRAPERIPHERAL COLLISIONS AT RHIC

Jhenieve Enriquez, Department of Physics, Creighton University, Omaha, NE 68178

The Relativistic Heavy Ion Collider (RHIC) is located at Brookhaven National Laboratory. RHIC accelerates heavy ions, particularly gold, to almost the speed of light in two anti-parallel beam lines. The STAR (Solenoid Tracker at RHIC) detector is located at a point where these beam lines intersect and collisions may occur. We focus on ultraperipheral collisions, where the ions completely miss another but still pass closely enough to interact electromagnetically. As a result of these collisions, particles such as the rho meson and the J/psi meson are produced. In order to extract the cross sections for producing these particles, we must find the efficiency of the detector for the reconstruction of events. We use Monte Carlo simulations in our calculations of efficiencies. We will discuss the observation of vector mesons in ultraperipheral collisions and present preliminary calculations of reconstruction efficiencies for the rho and the J/psi mesons.

#### MEASURING POSITION AND TIME OF IMPACT OF IONS FORMED BY ELECTRON- MOLECULE COLLISIONS

Kiersten N. Mavis, and D. R. Sieglaff, Department of Physics and Astronomy, Nebraska Wesleyan University, Lincoln, NE, 68504

A position sensitive detector (PSD) is being used to measure the position and time of arrival of ions formed by electron impact. A National Instruments (NI) compact reconfigurable input/output (cRIO) 9073 automation controller is programmed using NI LabVIEW 2011 to trigger an electron beam pulse. The electrons traverse a region containing gas molecules. Positively ionized particles created from collisions with the electrons are extracted by a pulsed electric field to strike the PSD. The cRIO is used to sample the output of an EG&G Ortec 566 time to amplitude converter (TAC), which measures the time of flight of the ion, and a Quantar 1201B Position Analyzer, which measures the position of impact in two dimensions. By determining both the time and position of impact of the ions, it is possible to ensure that all collision products are collected by the PSD, and therefore that ionization cross sections measure by the described method are free of collection efficiency error. Progress toward the described measurements is presented.

## VENTURI EFFECT AND ITS PRESENCE AT PEDESTRIAN LEVELS BETWEEN TWO LONG NARROW BUILDINGS

Raymond Hughey Jr, Department of Physics, Hastings College, Hastings, 68901

The Venturi Effect states that the velocity of a fluid increases and the static pressure decreases as the cross sectional area diminishes. The laws governing fluid dynamics, specifically the principle of continuity, Newton's second law, and Bernoulli's principle create a foundation from which the Venturi Effect can be explained. The Venturi Effect was investigated at pedestrian level (2m full scale) between two long narrow buildings in an open area exposure. Various building orientations and separations were investigated. A wind tunnel, pitot tube, and hot wire anemometer were used to measure flow velocities and pressures adjacent to the buildings. The experimental results were then compared with those generated by a computational fluid dynamics (CFD) program.

## RHO MESON YIELD AS A FUNCTION OF EVENT MULTIPLICITY IN ULTRAPERIPHERAL COLLISIONS AT RHIC

Jamison Duckworth (for the STAR Collaboration), College of Arts and Sciences, Creighton University, Omaha, NE 68178

The Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory collides beams of ions together at velocities near the speed of light. In ultraperipheral collisions two ions miss entirely but an electromagnetic interaction still occurs between the beams. STAR, a Solenoidal Tracker At RHIC, has measured the rho meson photoproduction cross sections in ultraperipheral collisions at various energies. This presentation will discuss a recent analysis that shows how the yield of rho mesons depends on the total number of tracks allowed in events selected for analysis.

## RAYLEIGH INSTABILITY OF CHARGED LIQUID DROPLETS: WHERE A QUADRUPOLE TRAP AND MIE SCATTERING MEET

Neil Sabata, Department of Physics, Hastings College, Hastings, NE 68901

An experiment was conducted in which the fission of an electrically charged ethylene glycol droplet by Rayleigh charge instability was observed. Rayleigh charge instability occurs when the electrostatic repulsion between the charges on the surface overcomes the droplet's surface tension, tearing the droplet apart. The charged droplets were suspended using a quadrupole trap. Using angular light scattering measurements and Mie scattering theory the droplet radii were determined. A comparison of the scattering results with the Rayleigh criterion for drop fission and charge distribution was done.

## GENERATING SIMULATIONS FOR THE $J/\psi$ MESON IN ULTRA PERIPHERAL COLLISIONS AT STAR USING STARLIGHT

Gleb Bataikin, Department of Physics, Creighton University, Omaha, NE 68178

At the Relativistic Heavy Ion Collider (RHIC) ions are collided at relativistic speeds. Ultraperipheral collisions are events involving two colliding ions that do not physically overlap but interact electromagnetically. For the first time at STAR (Solenoidal Tracker At RHIC), the 2010 200 GeV Gold-Gold data contains evidence of  $J/\psi$  particles in ultraperipheral collisions. The  $J/\psi$  decays into electron-positron pairs that are indistinguishable from electron-positron pairs produced directly in ultraperipheral collisions. STARlight is a program written in C++ that simulates events produced in ultraperipheral collisions using virtual photon exchange. Using STARlight it is possible to produce a model of the expected contribution of direct electron-positron pairs in the  $J/\psi$  signal. This model can be

compared to real data. This talk will describe how simulations are obtained for the  $J/\psi$  meson using STARlight.

#### NASCAR AERODYNAMICS

Colby Dolezal, Department of Physics, Hastings College, Hastings, NE 68901

Aerodynamics plays a significant role in NASCAR racing. While drafting behind the front car a low pressure/low velocity pocket of air aids in the reduction of drag on the following car. Drafting occurs when two or more cars trail a lead car therefore gaining speed due to the reduced drag. Using a wind tunnel, a 1/63rd model experimental car and two 1/63rd model dummy cars were tested. Various velocities and frontal exposures were used to determine the Pressure Coefficient, Reynolds Number, Drag Coefficient, Lift Coefficient, and the Down Force acting on the test vehicle.

#### THE EFFECT OF THERMAL FLUCTUATIONS ON RESISTIVITY FOR THE HIGH-TEMPERATURE SUPERCONDUCTING FILM YBCO

Nick Tramp, Department of Physics, Hastings College, Hastings, NE 68902

An experiment which characterized the high temperature superconducting film Yttrium-Barium-Copper-Oxide (YBCO) close to its phase transition by measurement of the dc resistivity of the film as a function of temperature was performed. Through direct measurements of the resistivity of the sample a value of  $T_c$ , the critical superconducting temperature, was determined. Assuming the resistivity jump at the phase transition to be smoothed on either side, a value of  $T_c$  was found at the mid-point of this transition. Ginzburg-Landau formalism is used to compare experimental results with theory for the in-plane conductivity in the temperature range roughly 2-10% higher than  $T_c$ . The cryogenic test system consisted of an insulated vessel with an inner cavity containing the YBCO sample, all within a liquid nitrogen surround. Temperature measurements were made using a Platinum Resistance Thermometer (PRTD) with associated electronics.

#### ON THE GAS PHASE DEUTERATION OF 1-BUTENE

Nhu Le, Anne Mirich, and Bruce Mattson, Department of Chemistry, Creighton University, Omaha, NE 68178

We have studied the gas-phase deuteration of 1-butene with deuterium gas over a palladium-coated ceramic support. The reaction proceeds by several cycles of deuterium-hydrogen exchange followed by elimination of polydeuterated butane. The extent of deuteration can be estimated by modeling the propyl fragments produced in the mass spectrum and is found to be about 6 – 8% and 27 – 29% for the two propyl fragments produced from the host of deuterobutane isotopomers. NMR indicates that butane production exceeds 90% and unreacted 1-butene is not deuterated. Increasing the amount of deuterium increases the amount of unreacted 1-butene, suggesting that deuterium preferentially binds to the palladium.

#### LIPID PEROXIDATION STUDIES IN COMMONLY USED COOKING OILS: CORELATION WITH POLYPHENOL CONTENT

Ana Laura Ortiz-Morales and Ganesh Naik, College of Saint Mary, Omaha NE 68106-2377

Frying is a commonly used process for cooking from the food industry to inside the home. Lipid peroxidation can be prevented by the presence of polyphenolic compounds, which are naturally present in cooking oils, and by adding antioxidants. In our research project, we used the Follin Ciolateau reagent which contains a combination of tungsten and molybdenum oxides, reacts with phenolic reducing substances to form chromogens absorbing at 765nm which can be quantitatively measured using a spectrophotometer. The Gallic acid is used as standard and the total polyphenols present in oil samples were estimated as Gallic acid equivalents. The polyphenol correlation studies in different oil samples



during the preparation of French fries will help us to understand the role of polyphenols in preventing the lipid peroxidation process.

#### PROGRESS TOWARD MODELING PEPTIDE-MINERAL INTERACTIONS IN BIOMINERALIZATION SYSTEMS USING ROSETTASURFACE

Adrian Draney, M.V. Wilson, and E. Wilson, Department of Chemistry, Doane College, Crete, NE 68333

The activity of proteins and peptides on mineral surfaces depends on the orientation and interaction of the protein with that surface. While determination of a surface-adsorbed protein's structure and interface with a solid surface can be expensive and difficult to perform experimentally, the Rosetta protein modeling suite has been shown to model these interactions using the RosettaSurface package. Our progress in adapting this package to the study of peptides of the bone matrix protein osteopontin will be discussed.

#### PREDICTION OF THE PKA OF SEVERAL CARBOXYLIC ACIDS FROM DFT STUDIES

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The determination of the pKa of acids via experimental procedures can be very challenging. The experimental procedure involves obtaining pure samples and the proper determination of end points, which becomes more difficult for the weaker acids. A related problem is the determination of the protonation/deprotonation site for acids with multiple protonation sites. Recently, a procedure was devised in our laboratories to predict the pKa of protonated nitrogenous bases using HF methods and Cramer-Truhlar solvation schemes utilizing commercially available computational programs. We have extended this procedure to an analysis of acids by employing the B3LYP/6-31++G(d,p) model chemistry coupled with Tomasi's Polarized Continuum Model (PCM), the Polarizable Conductor Model (CPCM), and the Self-consistent Isodensity Polarized Continuum Model (SCIPCM) as implemented in the Gaussian 09 software suite in an attempt to determine the most efficient model chemistry/resource consumption ratio.

The selected acids and their conjugate bases were completely optimized to a stationary point on the Born-Oppenheimer surface. The difference in the computed energies of the acid and its conjugate base was graphed against experimental pKa in an effort to identify a trend in which computed dissociation energy closely correlates with experimental pKa.

#### LIPID PEROXIDATION STUDIES IN COMMONLY USED COOKING OILS: HPLC METHOD TO DETECT THE MALONDIALDEHYDE

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Frying is a commonly used process for cooking from the food industry to inside the home. During the frying process, oils undergo lipid peroxidation and produce reactive aldehyde products such as 4-hydroxynonenal and malondialdehyde. These compounds are known to react with DNA and protein in the cells causing cytotoxicity. In our research project we are developing an HPLC-UV-V absorbance method to quantitate the malondialdehyde, the lipid peroxidation product formed during degradation of oils. The malondialdehyde standards used in this method were prepared by the hydrolysis of 1,1,3,3-Tetramethoxypropane. HPLC method provides more specificity over the traditionally used Thiobarbituric acid reactive substance method commonly known as TBARS method.